

PROPOSAL FORM
BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
TOWSON, MARYLAND

Division of Construction Contracts Administration

ARCHITECT

JMT
40 Wight Avenue, Hunt Valley,
Maryland 21030
Phone: 410-372-4617



Contract Number 25030 PO0
Property Management Project
911 Center UPS Replacement –
401 Bosley Avenue, Towson, Maryland 21204
Towson – District 9c6
Workday Number
PROJ-10001155

CONTRACT BASED ON SEPTEMBER 2023
STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS
AND STANDARD DETAILS FOR CONSTRUCTION

Bidders Information

A pre-bid meeting will be held on Wednesday, June 18, 2025 at 10:00 a.m. EST via WebEx. *Phone-In* (Audio Only) 1-415-655-0001, Meeting Number 2300 812 2718##. *Video Conference* go to <https://signin.webex.com/join> Meeting Number 2300 812 2718, **Password: n2eGz8K6m3P**, for Webex link go to: www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

Baltimore County First Source Hiring Agreement **see pages 545-546**. State Prevailing Wage Requirements & Wage Rates **see pages 547-553**

(Contract Disclosure): “Wage rates that are in effect as of the contract solicitation date will be the wage rates through the duration of the project”

MBE/WBE Requirements & Forms **see pages 554-568**

THIS PROPOSAL FORM INCLUDES AND INCORPORATES ALL DOCUMENTS AND INFORMATION REFLECTED, LISTED, AND/OR REFERENCED IN THIS TABLE OF CONTENTS, AND ALL SUCH DOCUMENTS AND INFORMATION ARE PART OF AND INCORPORATED INTO THE CONTRACT DOCUMENTS.

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SECTION I

INFORMATION FOR BIDDERS

ELECTRONIC SUBMITTAL PROCESS

To be considered, Bids (Section IV – Proposal) shall be received by the bid closing date and time to the following email address dpwbid@baltimorecountymd.gov. The contract number and company name should be referenced in the Subject Line of the email. Bids may not be submitted by any other means. Bids that are mailed or otherwise delivered to the Purchasing Division (including emails which indicate links to locations where the bid may be downloaded) and/or emails sent to any other Baltimore County email address will not be accepted.

Late Bids will not be considered. Bidders are strongly encouraged not to wait until the last minute to submit bids. The time stated on the auto-receipt (described below) will be definitive of the time of receipt. Bids received after the deadline will not be accepted. Bidders are advised that the County cannot receive email attachments greater in size than twenty-five (25) megabytes and this size limitation may be further reduced by requirements of the Bidder's email provider which are beyond the control of the County. Bidder should consider separating any large bid attachment into multiple parts and emailing each part separately. In such case, Bidder will note that each email is *1 of 2*, *2 of 2*, etc. Multiple part bids will not be considered unless all parts are received by the bid closing date and time.

After submitting a Bid to dpwbid@baltimorecountymd.gov, and upon successful receipt by the County thereof, Bidder will receive an auto-receipt email. This receipt is proof that the bid has been received by the Division of Construction Contracts Administration and should be retained for Bidder's records. In the case of a bid submitted in multiple parts as described above, an auto-receipt email will be generated for each part. The County has no obligation to consider any Bid for which an auto-receipt was not generated.

As with any system, power outages or technology problems may arise that are outside of the County's control and could affect your submission. The County will not be held accountable for such issues that may delay the transmission of any Bid.

NOTE: Electronic copy of the Bid Bond will be accepted at bid opening. The apparent low bidder is required to submit the original Bid Bond within ten (10) days after the bid opening to the Division of Construction Contracts Administration, 111 West Chesapeake Avenue, Room 300B, Towson, Maryland 21204.

INSTRUCTIONS AND SPECIFICATIONS

Refer to the enclosed proposal sheets for quantities to be bid upon. All proposals submitted on the attached form must give the price in clear figures for each item of the proposed work and be signed by the bidder with his name and address. Bidders must not change any item in the proposal for which a price has been stipulated by the County. Any change will cause rejection of the proposal.

NOTE: STATEMENT UNDER OATH FORM TO ACCOMPANY BID as per Baltimore County Purchasing Act 65-98, Section 15-94 and 15-95 which requires that the enclosed affidavit (see Proposal Affidavit pages in Section IV) be completed and submitted as part of the sealed bid.

Proposals made on any other than the attached form will not be considered. All papers included in, bound thereto, or attached to the Proposal Form are necessary parts thereof and shall not be detached, separated, or altered in their intent.

Changes in the phraseology of the proposal, additions, or limiting provisions will render the proposal informal or void and may cause its rejection.

All right is hereby reserved by the Purchasing Agent to reject any or all proposals and to waive formalities and technicalities as the interest of the County may require.

No successful bidder may withdraw his bid within NINETY (90) days after the opening thereof.

The successful bidder will be required to be bonded to Baltimore County, Maryland to the sum of One Hundred per Cent (100%) of the amount of his proposal or proposals according to the form of bond hereto attached for projects in excess of \$25,000.00.

This Proposal must be accompanied by a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment of the amount thus determined in case of a default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award. The Bid Bond must be in the form accompanying the Proposal executed by a Surety licensed in the State of Maryland. The Surety must be currently rated "B" or better by the A. M. Best Company, and the bid must be in an amount less than, or equal to, the underwriting limitation contained in Department of Treasury Circular 570 as amended at the time of the underwriting.

All work to be performed under this contract shall be done under strict compliance with Baltimore County Department of Public Works and Transportation September 2023 Standard Specifications for Construction and Materials and Standard Details for Construction and any and all proposed revisions thereto as of the date of advertisement and copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards, and all of which are made a part hereof and incorporated herein (collectively, the "Specifications").

If the bidder to whom an award is made shall fail to execute the contract and bond hereto attached and as herein provided, the award may be annulled and the contract awarded to the lowest responsible bidder who has consented to a time extension, and such bidder shall fulfill every stipulation embraced herein as if he were the original party to whom the award was made, or the Purchasing Agent may reject all of the bids as the interest of the County may require.

The Bid Bond of the three lowest bidders is deemed to be effective until the execution and delivery of the Contract Agreement, together with Payment and Performance Bonds for projects in excess of \$25,000.00 or until rejection of all bids, whereupon Surety is deemed relieved of all further obligations under the bid bonds provided.

Bidders must examine the drawings and specifications carefully and must make a personal examination of the location and nature of the proposed work. In case doubt shall arise as to the meaning or intent of anything shown on the drawings or comprised in the specification, inquiry shall be made of the Director of Public Works and Transportation at least five (5) days prior to the date of

bid opening. The submission of the Proposal shall indicate that the bidder thoroughly understands the drawings and the terms of the Specifications.

To better ensure fair competition and to permit a determination of the lowest bidder, unresponsive bids or bids obviously unbalanced may be rejected by the Purchasing Agent.

Bidders are required to fill out the total price column and total their proposals so that the result of the bidding, barring possible arithmetical errors, will be known at once. Any errors in computations will be corrected by the Engineer when the proposals are canvassed. Where the unit price and the total price are at variance, the unit price will prevail.

Bidders must be prepared to complete the work within the time stated in the proposal.

NOTE: ONLY CONTRACTORS FORMALLY PRE-QUALIFIED WITHIN THE ADVERTISED WORK CLASSIFICATION BY THE DIRECTOR OF PUBLIC WORKS AND TRANSPORTATION OF BALTIMORE COUNTY 10 CALENDAR DAYS PRIOR TO BID OPENING WILL BE ELIGIBLE TO SUBMIT BIDS.

Contracts for work under this proposal will obligate the contractors and subcontractors not to discriminate in employment practices. Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the contract. Successful bidders must be prepared to comply in all respects with the Contract Provisions regarding nondiscrimination.

Baltimore County has adopted a Minority Business Enterprise (MBE) program and Women's Business Enterprise (WBE) Program. The percentage of participation applies to the contract amount awarded to the Contractor. Qualified minority subcontractors are those certified as being a Minority Business Enterprise by the following:

1. Maryland Department of Transportation Certification Committee (MDOT)
2. City of Baltimore, Minority Business Certification Council

Projects funded by the Federal Highway Administration are limited to the certification listed under #1 (MDOT).

More detailed information regarding the County's MBE/WBE Program can be obtained from the County MBE Office, telephone (410) 887-3407. See Executive Order dated December 6, 2022. MBE/WBE Participation Summary and Forms A, B, C, D and E enclosed in this proposal booklet.

NOTE: If you do not complete and submit the enclosed forms with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer **NON-RESPONSIVE** and accordingly the **COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.**

The County reserves the right to require the low bidder to produce evidence indicating that the company's financial condition is equal to, or better than, that enjoyed by the company at the time of prequalification. This additional information may be in the form of a financial statement or other evidence satisfactory to the Office of Budget and Finance.

Bidders' attention is directed to the requirement that a permit must be obtained from the Baltimore County Bureau of Highways and Bureau of Traffic Engineering prior to cutting any County

road for the purpose of obtaining sub-surface soils information, and permission must be obtained from the State Highways Administration prior to making any openings in a State road.

Under no circumstances shall a bidder enter upon any property outside a County or State road for the purpose of securing sub-surface soils information until permission is received from the property owner. The fact that the County has obtained a utility easement does not give the bidder the right to enter upon the property.

Prevailing index price of asphalt cement/ton \$640.00.

INCLEMENT WEATHER POLICY: If Baltimore County General Government Offices are open or open with liberal leave the day the bids are due, the bids are due as stated in the bid documents (date and time). **ONLY** when the Baltimore County General Government Offices are **OFFICIALLY CLOSED** the day the bids are due, the bid date will be postponed and an Addendum will be issued the next business (or next day buildings are officially open) day the county offices are open with the new bid date and time.

BID TABULATIONS: All bid tabulations will be confidential until after final award, at which time the total bid amounts for all bidders, as well as the complete bid tabulations for the top three (3) bidders, can be inspected by others when requested in writing pursuant to the Maryland Public Information Act.

ALTERNATIVE SOURCES OF CONTRACT BONDS: In the event your company is unable to qualify for bonding through a traditional commercial surety company, you may qualify for the required bonds through the State of Maryland, Department of Commerce (DOC). The **Maryland Small Business Development Financing Authority (MSBDFA, pronounced Mis-Bid-Fa)**, an agency of DOC, operates a Surety Bond Program designed to assist small businesses, based in Maryland, that are unable to obtain adequate bonding on reasonable terms in the commercial marketplace. MSBDFA provides bid, payment and performance bonds for contracts funded by government agencies, regulated utilities and private entities. The penal sums of the bonds are limited to the aggregate amount of \$2,500,000 and companies may pre-qualify for multiple bonds within pre-approved terms and conditions. MSBDFA also provides lines of credit, term loans and loan guarantees to help qualified businesses purchase equipment and real property, make improvements to leased property, refinance existing debt and assist them with their working capital needs. For more information on how to apply, you may contact: Meridian Management Group, Inc. (MMG), (the Program's Manager), 826 E. Baltimore Street, Baltimore, Maryland 21202, Telephone: (410) 333-4270. Or visit their website at www.mmcapitalgroup.com for information, applications and a checklist of required documents and reports that must accompany the application.

S E C T I O N I I

SPECIAL PROVISIONS

MAINTENANCE BOND

Per the Baltimore County Department of Public Works and Transportation September 2023 Standard Specifications for Construction and Materials, Section GP – 4.10 (C) states, the contractor is required to post a maintenance bond in the amount of five (5) percent of the total cost of the contract or withhold five (5) percent retainage for two (2) years from the date of Final Acceptance.

BALTIMORE COUNTY, MARYLAND

BOND NO. _____

CONTRACT NO. _____

MAINTENANCE BOND

THIS MAINTENANCE BOND is entered into on this _____ day of _____, 20____, by and between _____, as principal ("Principal") and _____, a business entity that is authorized to transact business in the State of Maryland and is organized and existing under the laws of the State of _____, as surety ("Surety"), are held and firmly bound unto Baltimore County, Maryland, a body corporate and politic of the State of Maryland ("County"), as Obligee.

WHEREAS, the above-named Principal has entered into a written contract known as Contract Number _____ dated _____, 20____ with Obligee for _____ (the "Agreement"), the terms of which are hereby incorporated by reference; and

WHEREAS, Principal has completed construction under the Agreement; and

WHEREAS, the Agreement includes a warranty on the quality of the Work performed that runs for a period of two (2) years from the date of the County's final acceptance and that runs for two (2) additional years beyond the repair date if any repair is done during the warranty period; and

WHEREAS, Principal is required to cause this instrument to be executed and delivered to Obligee as security for maintenance during the warranty period in an amount equal to 5% of the total value of the Contract.

NOW, THEREFORE, the Principal and Surety are held and firmly bound unto the Obligee in the sum of \$ _____ Dollars (\$ _____), lawful money of the United States of America, for the payment of which sum of money the Principal and Surety do bind themselves and their personal representatives, legal representatives, successors, and assigns, jointly and severally, firmly by this maintenance bond.

The conditions of this bond are as follows:

1. The Principal shall, for a period of two (2) years from and after the date of completion and acceptance of same by Obligee, replace all defects arising in the Work, whether resulting from defective materials, equipment, design furnished or workmanship. After such period, this obligation shall be null and void; otherwise it shall remain in full force and effect.

2. In the event of a default on the part of the Principal that may be the subject of a claim under this bond, Obligee shall mail, by certified mail, to Surety at the address listed below, a written statement that a claim is being made under the bond and, with substantial accuracy, the amount of the claim. Surety shall have no obligation to Obligee under this bond until the notice of claim is mailed.
3. When the Obligee has satisfied the condition of Paragraph 2 that a notice of claim be mailed, the Surety shall promptly and at the Surety's expense send an answer to Obligee within 30 days after the date of the claim. The answer shall state the amounts that are undisputed and the basis for challenging any amounts that are disputed. The answer shall be accompanied by payment (or arrangements for immediate payment) of any undisputed amounts.
4. Surety expressly waives any right to receive notice of extensions of time or alterations or modifications to the Agreement that may be granted by Obligee and agreed upon by Principal, and any such extensions, alterations, or modifications shall not affect the obligation of the Surety under this bond.
5. This bond is a specialty governed by the twelve-year statute of limitations period set forth in the Annotated Code of Maryland Courts and Judicial Proceedings §5-102.

WITNESS OR ATTEST:

(Principal – Contractor Name)

By: _____

Type Name: _____

Type Title: _____

Date: _____

(Surety)

By: _____

Type Name: _____

Type Title: _____

Type Address: _____

Date: _____

The Contract shall be done in strict compliance with the Baltimore County Department of Public Works and Transportation September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction", and any and all revisions thereto as of the date of the fully executed Contract, including but not limited to the General Conditions Building Projects, as applicable, and all of which are made a part hereof and incorporated herein (collectively, the "**Specifications**"). Copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards. **IN ADDITION, THE CONTRACTOR UNDERSTANDS AND AGREES THAT THE FOLLOWING SECTIONS OF THE SPECIFICATIONS (GP-1.03 AND GP-5-15) SHALL BE STRICKEN AND THE FOLLOWING SHALL BE INSERTED IN AND INCORPORATED INTO THE CONTRACT IN LIEU THEREOF:**

GP-1.03 ORGANIZATIONAL DEFINITIONS

Administration - Baltimore County.

Administrator - The Director of the Office of Budget and Finance, Baltimore County.

Baltimore County - Baltimore County, Maryland: a body corporate and politic.

Department - The word "Department" shall mean the Office of Budget and Finance of Baltimore County.

Engineer - One of the following engineering executives:

Director of Office of Budget and Finance
Chief, Property Management Division of the Office of Budget and Finance

Any delegation of the Engineer's authority must be authorized in writing by any one of the above listed officials, and such delegation of authority will pertain only to the specific contract and/or contracts shown by the authorization. The title of the specific official will appear in those cases within these specifications where the word "Engineer" as defined herein is not sufficiently specific.

Inspector - The authorized representative of the procurement officer assigned to make detailed inspection of any or all portions of the work, or materials therefor.

Procurement Officer - See Engineer.

GP-5.15 DISPUTES

(a) Except as otherwise may be provided by applicable law or regulation, all disputes arising under or as a result of a breach of this Contract that are not disposed of by mutual agreement shall be resolved in accordance with this General Provision.

(b) As used herein, "claim" means a: written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of Contract terms, or other relief, arising under or relating to this Contract.

A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim under this General Provision. However, if the submission subsequently is not acted upon in a reasonable time, or is disputed either as to liability or amount, it may be converted to a claim for the purpose of this General Provision.

- (c) When a claim cannot be resolved by mutual agreement, the Contractor shall submit a written request for decision to the Department's Chief of the Property Management Division for his decision in consultation with the County Office of Law. The Contractor's written request shall set forth all the facts surrounding the controversy, including, but not limited to, those items listed in GP-5.14(b). Any claim by the County shall be decided in like manner.
- (d) The Contractor, at the discretion of the Engineer, may be afforded an opportunity to be heard and to offer evidence in support of his claim. Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract.
- (e) The Department's Chief of the Property Management Division shall decide any and all claims. The decision by the Department's Chief of the Property Management Division shall be issued within ninety (90) Days on matters of less than fifty thousand dollars (\$50,000) and within one hundred eighty (180) Days on matters of fifty thousand dollars (\$50,000) or more. The written decision of the Department's Chief of the Property Management Division shall be final and binding unless appealed in writing to the Director of the Department within thirty (30) Days of the Chief's written opinion to the parties. If the Chief's decision is timely appealed in writing to the Director of the Department, the Director of the Department, serving as referee, will review the written appeal submitted to assure all reasonable attempts were made to resolve the appeal.
- (f) The Director shall issue his/her decision in writing within ninety (90) Days. The Director's decision shall be final and conclusive unless a written appeal is mailed or otherwise filed with the County Administrative Officer within thirty (30) Days of the Director's written decision.
- (g) When the County Administrative Officer is satisfied all efforts at the Department level were made to resolve the dispute, a claim shall be resolved as follows:

 - (1) Subject to, and without in any way enlarging or limiting the other provisions of the Contract, the parties to any Agreement which adopts or incorporates by reference these Standard Specifications, appoint the County Administrative Officer as an administrative hearing officer pursuant to Article 25A, "Chartered Counties of Maryland", of the Annotated Code of Maryland.
 - (2) The parties further grant the County Administrative Officer the right to delegate this responsibility and authority in writing to a County official who is a registered professional engineer, independent of the Department of Public Works and Transportation's Division of Construction Contracts Administration, or to any other County official.
 - (3) For disputes involving ten thousand dollars (\$10,000) or more the decision of the administrative hearing officer shall be final and binding on both parties, subject only to such appeals on the record as provided by Article 25A. For disputes involving less than ten thousand dollars (\$10,000), the decision of the administrative hearing officer shall be final and binding on both parties.

GENERAL CONDITIONS

BUILDING PROJECTS



**Revised September 1, 2024,
in compliance with September 2023
Standard Specifications for Construction and Materials**

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GENERAL CONDITIONS DESIGN BUILD BUILDING PROJECTS

I. SPECIFICATIONS

Article 1 Applicable Specifications

All work performed under this Contract shall be done under strict compliance with the *Specifications* bound herewith, and with the *Baltimore County Standard Specifications for Construction and Materials* and the *Standard Details for Construction* dated September 2023 and subsequent addenda thereto, so far as the same may be applicable, copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards. These General Conditions are in addition to the aforementioned Specifications. Should there be any conflict with the aforementioned manuals, the *General Conditions* take preference.

II. DEFINITIONS

Article 2 Definitions

- A. *Architect and/or Engineer* shall mean the registered Architect and/or Engineer commissioned by the County to prepare the plans and contract documents.
- B. *Engineer* in these General Conditions and in the Construction Specifications in some instances refers to authorized representatives of the Office of Budget and Finance, Property Management.
- C. *Subcontractor*, as employed herein, includes only those having a direct contract with the Contractor. It includes one who furnished material worked to a special design according to the Plans and Specifications for the "work." It excludes one who merely furnished material not so worked.
- D. *Written Notice* shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered to or sent by registered mail to the last business address known to him who gives the notice.
- E. *Repair* means to restore after injury, deterioration, or wear; to mend, to renovate, by such means as appropriate, and to supply such materials and labor as necessary to render the item to be repaired sound, solid, true, plumb, square, even, smooth, and fully serviceable. Upon completion of such repair it must be, unless otherwise stated, rendered to such condition as to present a first-class finished work, or in instances where the repaired item serves as a base for additional finish, the repaired work must be such as to permit a first-class finish, to be applied without extra cost to the County. When the word "repair" is used in connection with machinery or mechanical equipment, it shall mean, in addition to the above, rendering the equipment completely serviceable and efficient, ready for the normal use for which it was originally intended.

- F. Some parts of the "Construction Specifications," bound herewith are of the abbreviated or "streamlined" type and includes incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "according to the plans", "a", "an", "the", and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings. Words "shall be" or "shall" will be supplied by inference when colon (:) is used within sentences or phrases.

Article 3 Time Limits

The proposal shall indicate whether the contract limit is based on Working Days or Calendar Days. If this is not indicated in the Proposal, then the time limits will be based on Calendar Days.

Article 4 Sunday, Night and Holiday Work

If Sunday, night or holiday work is necessary due to an emergency or is permitted by the Engineer, the Contractor shall secure and pay for any and all permits required in connection with this work.

III. CONTRACT DOCUMENTS AND SHOP DRAWINGS

Article 5 Contract Documents

A. Clarification

It is assumed that the Contractor has obtained clarification of all questions which may have arisen as to intent of the contract documents, or assumed, or actual conflict between two or more items in the Contract Documents as required in "Instructions to Bidders." Should the Contractor have failed to obtain such clarification as required by the "Instructions to Bidders," then the Engineer may direct the work to proceed by any method indicated, specified or required by the Contract Documents in the interest of maintaining the best construction practice. Such direction by the Engineer shall not constitute a claim for extra by the Contractor.

B. Jargon

Work described in words that have a well-known technical or trade meaning shall be held to refer to such recognized standard use.

C. Drawings

The Contractor shall do no work without proper drawings and instructions. Drawings are, in general, drawn to scale; however, symbols are used to indicate materials and structural and mechanical requirements. When symbols are used, the drawings are, of necessity, diagrammatic, as it is not possible to indicate all connections, fittings, fastenings, etc., which are included as a part of the work. Diagrammatic indication of mechanical piping, ducts, and conduit within the buildings is subject to adjustment in order to obtain proper grading, passage over, under or past obstructions, to avoid exposure in finished rooms and unsightly and obstructing conditions. The Contractor shall coordinate these adjustments.

1. Copies no longer Furnished

The County will no longer furnish the Contractor any copies of the Drawings and Specifications. Additional copies may be obtained by the Contractor downloading drawings and specifications from the Baltimore County Solicitation Web Page.

2. Copies of the Work

The Contractor shall keep in the office on the job a complete set of all drawings, specifications, shop drawings, schedules, etc., in good order and available to the Engineer and representatives of the County.

3. Ownership

All documents as furnished by the County remain the property of the County. They must not be used on other work but shall be returned to the County upon completion of the work.

D. Large Scale Detail Drawings

The Architect shall furnish, when necessary, additional instructions in the form of large scale developments of the drawings used for bidding, or to amplify Construction Specifications for the proper execution of the work. These shall be true developments of the bidding documents and reasonably inferable there from. The work shall be executed in conformity herewith. [See Article 6, Paragraph A.3.(c)]

E. Dimensions

The Contractor shall carefully check all dimensions prior to execution of the particular work affected. Whenever inaccuracies or discrepancies are found, the Contractor shall consult the Engineer prior to any construction or demolition. Should any dimensions be missing, the Engineer will be consulted and supply them prior to execution of the work. Dimensions for items to be fitted into constructed conditions at the job will be taken at the job and will be the responsibility of the Contractor. The obvious intent of the documents or obvious requirements dictated by conditions existing or being constructed supersedes dimensions or notes which may be in conflict herewith.

Whenever a stock size manufactured item or piece of equipment is specified by its nominal size, it is the responsibility of the Contractor to determine the actual space requirements for setting or entrance to the setting space. No extra will be allowed by reason of work requiring adjustment in order to accommodate the particular item of equipment.

Whenever new work, building, addition or portions thereof are not accurately located by plan dimensions, the Engineer will supply exact position prior to execution of the work.

Article 6 Shop Drawings

A. Shop Drawings (those prepared by the Contractor or Vendor of Material)

The Contractor shall submit for the Architect's approval, at such times as agreed (see Article 8), shop drawings (to include setting drawings and schedules) as required for the work of the various trades. These drawings shall be prepared in conformity with the best practice and standards for the trade concerned. Due regard shall be given to speed and economy of fabrication and erection.

1. Items to be Detailed

Shop details shall be supplied for all items which are specially fabricated for the work or when the assembly of several items is required of a working unit. Shop drawings are required for all reinforcing and structural steel, specially made or cut masonry units, miscellaneous metal work, specially made flashings or roofing and sheet metal work, specially made millwork, special rough hardware and all heating, ventilating, plumbing and electrical requiring special fabrication or detailed connections, including ducts.

2. Submissions

Shop drawings, brochures and catalog cut submissions shall consist of sufficient copies to provide for the retention by the Architect and County of five (5) copies total plus such additional copies as the Contractor may require. Drawings shall not exceed 24 in. x 36 in. in size.

3. Examination and Approval

The Contractor shall review all shop drawings, brochures and catalog cuts provided by the subcontractors and vendors prior to submitting them to the Architect. The Architect shall examine shop drawings with reasonable promptness, noting desired corrections, or granting approval.

a. Field Dimensions and Conditions

The Architect is not responsible for the checking of dimensions or existing conditions in the field. This is the sole responsibility of the Contractor.

b. Resubmission

When the Architect's notations or corrections are extensive, then the Contractor shall resubmit the drawings with changes made on the drawings.

c. Contractor's Responsibility

Unless the Contractor has in writing, notified the Architect to the contrary, at the time of submission, it will be assumed that the drawings are in conformity with the Contract Documents and do not involve any change in the Contract price or any change which will alter the space within the structure or alter the manner of operation from that contemplated in the Contract Documents.

d. Architect's Notations

Should the Contractor consider any change or notation received in compliance with paragraph (c) above as increasing the cost of the work from that contemplated in the Contract Documents, then the Contractor shall desist from further action relative to the item he/she questions and shall notify the Engineer, in writing, within five (5) days of the additional cost involved. No work shall be executed until the entire matter is cleared or a Change Order issued, or the Contractor is ordered by the Engineer to proceed under the provisions of the County's Standard Specifications. Failure of the Contractor to serve written notice, as above required, shall constitute a waiver of any claim in relation thereto.

(1) Similarly, should the Architect's notation or change involve less work than is covered by the Contract Documents, the Contractor shall allow the County the credit resulting from the change.

(2) Should the Contractor consider that any notation or change made by the Architect under provisions of this paragraph, paragraph (c), above, as involving a complete change in the subcontractor's relation or the substitution of a material different from that on which the Contract was based, then the Contractor shall act as herein stated or as in paragraph (c) above.

4. Project Completion

At the completion of the project, the Contractor shall submit a list of shop drawings for the entire project. This list shall contain the following information: title, description, specialty (Architectural, Structural, Mechanical, etc.), decision (no exceptions taken, approved, approved as noted, etc.).

Article 7 Separate Contracts

A. The County reserves the right to let other contracts in connection with paving and utilities adjoining this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

- B. If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results. Failure to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of the work, except as to the defects which may develop in the other contractor's work after the execution of the work.
- C. To ensure the proper execution of his/her subsequent work, the Contractor shall verify work already in place and shall at once report to the Engineer any discrepancy between the executed work and the drawings.

IV. PAYMENTS

Article 8 Payments

- A. Under this Contract payments will be made monthly on the valuation of work accomplished and on account of materials delivered on the site, for incorporation in the work, which are suitably stored.
- B. At the first of each month, the Contractor shall submit to the Engineer an application for payment on a form provided by the Engineer. Prior to application for first payment, the Contractor shall submit to the Engineer a schedule of values for the various parts of the work, including quantities, aggregating to the total sum of the Contract. This shall be so divided as to facilitate payment to subcontractors in accordance with Article 28, Paragraph C.1. The form of this submission shall be such as the Contractor or Engineer have agreed upon, and, if required, shall be supported by such evidence as to its correctness as the engineer may direct. This schedule, when approved by the Engineer, shall be used as a basis for approval of payment unless it is found to be in error. In applying for payment, the Contractor shall submit a statement based upon the schedule, itemized in such form and supported by such evidence as the Engineer may require, showing the Contractor's right to the payment claimed. If required, the Contractor shall show receipts and other vouchers for the payments for materials and labor including payments to subcontractors, as required by Article 28.
- C. Materials Purchased Under Allowance

The Engineer will provide schedules for all materials to be purchased from specified allowance.

Article 9 Approval of Payments

If the Contractor has made application, as above, the Engineer shall review and approve such payments as is decided to be properly due in accordance with the approved schedule. In approving such partial payments, there shall be retained no more than 10% of the total amount for the first 50% of the contract, after which only 5% of the total amount of the contract may be withheld unless the need is demonstrated for retaining more to protect the public interest.

Article 10 Payment Withheld

- A. The Engineer may withhold, or on account of subsequently discovered evidence, nullify the whole or a part of any payment to such extent as may be necessary to protect the County from loss on account of:
1. Defective work not remedied.
 2. Claims filed, or reasonable evidence indicating probable filing of claims, by parties other than the Contractor.
 3. Failure of the Contractor to make payments properly to subcontractors or for material or labor.
 4. A reasonable doubt that the Contract can be completed for the balance then unpaid.
 5. Damage to another Contractor.
 6. Failure of the Contractor to submit data required within the time limits stated in the Contract Documents.

Upon removal of the above, payment shall be made for the amounts withheld.

Article 11 Changes in Work

- A. The County, without invalidating the Contract, may order changes in the work by altering, adding to or deduction from the work, the Contract sum being adjusted accordingly. Such change shall be executed under these *General Conditions*. Extension of time made necessary thereby shall be adjusted at the time of such Change Order.
- B. The Engineer shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purpose of the project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless a written order for the Office Budget and Finance, Property Management signed or countersigned by the Director has been received by the Contractor. No claim for addition to the Contract sum shall be valid unless so ordered.
- C. The value of any such extra work or change shall be determined in one or more of the following ways as determined by the Office of Budget and Finance, Property Management.
1. By Estimate and Acceptance of a Lump Sum
 - a. The prime Contractor shall furnish a breakdown of the estimated construction cost. The breakdown shall be of sufficient detail to describe the extra work and related costs for labor, material, overhead and profit.

b. Overhead and Profit

(1) Extra work by Subcontractor:

Subcontractor will be allowed 10% overhead and 10% profit added to the direct labor and material costs. The prime contractor will be allowed to increase the subcontractors total lump sum by 10% to cover his/her administration.

(2) Extra work by Prime Contractor:

The prime contractor will be allowed 10% overhead and 10% profit added to the labor and material costs.

- c. The prime contractor will be allowed 1 % for the bond added to the labor and material costs.
- d. The allowed overhead will include all supervision; no additional allowance will be made for it.

2. By Unit Prices Named in the Contract or Subsequently Agreed Upon

Such unit prices are to include all supervision, overhead, taxes, insurance and profit.

3. By Cost and a Fixed Fee

Added to the cost is a fixed fee portion which is to include supervision, overhead, insurance and profit.

4. By Force Account (Labor and Material Cost plus)

In accordance with the *Baltimore County Specifications for Construction and Materials* Section GP 9.02, the Contractor is allowed to add 65% mark-up.

- D. Should none of the methods stated in Paragraph C. 1, 2, or 3 be determined, the Contractor shall, providing he/she receives an order as defined in Paragraph B, above, proceed with the work on the basis of Paragraph C. 4. Force Account.

The Contractor and Engineer shall keep accurate costs, in such form as the Engineer may direct, for presentation, together with vouchers, to the Office of Budget and Finance Property Management for determination of the value of the work included in each Change Order. Pending determination of the final value, the Engineer may include payments for materials and labor, as stated in Article 8, in monthly vouchers.

Article 12 Claims for Extra Cost

No claim for extra will be granted which includes cost of delays or work stoppage due to strikes, lockouts, fire, avoidable casualties or damage or delay in transportation for which the County or its agents are not responsible. (See also Article 14.)

Article 13 Deductions for Uncorrected Work

If the Engineer and County deem it expedient to correct work injured or done not in accordance with the Contract, an equitable deduction from the Contract price shall be made therefore.

Article 14 Delays and Extension of Time

If no schedule or agreement stating the dates upon which drawings shall be furnished is made (see Article 8), then no claim for delay shall be allowed on account of failure to furnish drawings until two (2) weeks after demand for such drawings, and then not unless such claim is reasonable.

Article 15 Correction of Work After Final Payment

Neither the final certificate nor payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials and workmanship. Unless otherwise specified, the Contractor shall remedy any defects and pay for any damage to other work resulting there from that appears within the guarantee period. The County shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the Director of Budget and Finance, Property Management.

Article 16 (Deleted)

Article 17 Assignment

The Contractor shall not assign the Contract. It shall not be sublet as a whole or sublet by trades or other portions in an amount of more than 75% of the monetary value of the Contract. The remaining 25% shall be executed by the Contractor with labor and materials directly purchased and paid for by the Contractor. Costs for insurance, over-head, supervisions, etc., may not be claimed as a portion of the 25% mentioned above. The execution of work by a subsidiary of the Contractor is not considered direct employment. The Contractor shall not assign any monies due or to become due to him/her hereunder, without the previous written consent of the County.

Article 18 Maryland State Sales Tax

- A. Contractors who are performing work for the State of Maryland or any of its political subdivisions are required to pay tax on materials and supplies which will be incorporated into the work.

- B. The Contractor must pay the tax on all equipment which is purchased, Even though it may be used on a job for the State of any of its political subdivisions.

V. MATERIALS

Article 19 Materials

Materials include all manufactured products and processed and unprocessed natural substances required for completion of the Contract. The Contractor in accepting the Contract is assumed to be thoroughly familiar with the materials required and their limitations as to use and requirements for connections, setting, maintenance and operation.

Whenever an article, material or equipment is specified and a fastening, furring, connection (including utility connections), bed or accessory is normally considered essential to its installation in good quality construction, such shall be included as if fully specified. Nothing in the Construction Specifications shall be interpreted as authorizing any work in any manner contrary to applicable law, codes or regulations (See Article 31).

A. Approval

All materials are subject to the Architect's or Engineer's approval as to conformity with the specifications, quality, design, color, etc. No work for which approval is necessary shall be contracted for, or used, until written approval is given by the Architect or Engineer. Approval of a subcontractor, as such, does not constitute approval of a material which is other than that included in the Construction Specifications.

B. New Materials

Unless otherwise specified, all materials shall be new.

C. Quality

Unless otherwise specified, all material shall be of the best quality of the respective kinds.

D. Samples

The Contractor shall furnish for approval all samples as directed. The work shall be the same as the approved samples.

E. Painting and Color

The Architect and Contractor shall jointly prepare the paint and color schedules. The Architect shall direct the exact color, texture and finish.

F. Proof of Quality

The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials either before or after installation. The Contractor shall pay for any tests as may be deemed necessary in relation to "Substitutions" (Paragraph I. below).

G. Contractor's Option

When several products or manufacturers are named in the Construction Specifications for the same purpose or use, then the Contractor shall select any of those so named. However, all of the units of a thing required for a project must be the same in material and manufacture.

H. "Or Equal", "Equal", "Approved Equal"

The above terms are used as synonyms throughout the Construction Specifications. They are implied in reference to all named manufacturers. Only materials that, in the opinion of the Engineer, are fully equal in all details of construction, methods of assembly, finish and design quality will be considered. (See A, C, E, above, and I. below.)

I. Substitutions

Should the Contractor desire to substitute another material for one or more specified by name, the Contractor shall apply, in writing, for such permission and state the credit or extra involved by the use of such material. The Engineer will not consider the substitution of any material different in type or construction methods unless such substitution effects a benefit to the County. (See A. and D. above.)

The Contractor shall not submit for approval, materials other than those specified without a written statement why such a Substitution is proposed. Approval of a "substitute" material by the Architect or Engineer when the Contractor has not designated such material is a "substitute," shall not be binding on the County nor release the Contractor from any obligations of the Contract, unless the Architect or Engineer approves such "substitutions" in writing.

J. Standard Specifications

Whenever references are made in the Contract Documents to the *Baltimore County Standard Specifications for Construction and Materials* and *Standard Details for Construction*, it shall be understood that the latest standards and/or requirements are intended and shall apply. When no specification is cited and the quality, processing, composition or method of installation of a thing is only generally referred to then:

1. For things not otherwise specified below, the latest edition of the Applicable American Society for Testing Materials Specifications shall apply.

2. For things covered by the applicable portions, the National Bureau of Fire Underwriters Code shall apply.
3. For things generally considered as plumbing and those things requiring plumbing connections, the applicable portions of the latest edition of the American Society of Mechanical Engineers Code and the Baltimore County Plumbing Code shall apply.
4. For things generally considered as heating and ventilating work and not covered by A.S.M.E. Code, the applicable portions of the latest edition of the Heating and Ventilating Guide, published by the American Society of Heating and Ventilating Engineers, and the Baltimore County Building Code shall apply.

K. Storage

The contractor shall confine apparatus and storage of materials to the "off-road" area delineated as the "Limit of Contract." The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger the safety of the structure or any part thereof.

VI. QUALIFICATION, EMPLOYEES, WORKMANSHIP, SUBCONTRACTORS AND ADVERTISING

Article 20 Qualification of Bidders

Bidders are required to be prequalified 10 days prior to bid opening, satisfactorily evidencing that they have the ability, equipment, organization and financial resources sufficient to enable completion of the work satisfactorily within the time specified in the Proposal.

Article 21 Employees and Workmanship

A. Employees

1. Qualification

Only personnel thoroughly trained and skilled in the task assigned them may be employed on any portion of the work, or they shall be removed.

2. Licensed

When County, State or Federal laws require that certain personnel (electricians, plumbers, etc.) be licensed, then all such personnel employed on the work shall be so licensed.

B. Quality of Labor

The Contractor shall employ on the work, at all times, sufficient personnel to complete the work within the time stated in the Proposal.

C. Work Areas

The Contractor shall confine the operations of his/her employees to the limits as provided by law, ordinance, permits or directions of the Office of Budget and Finance Property Management. Generally, the "off-road" area will be the same as the "limit of Contract" line.

D. Methods and Quality

1. All workmanship shall be of good quality. Whenever the method of the work or manner of procedure is not specifically stated or shown in the Contract Documents, then it is intended that the best standard practice shall be adhered to. Recommendations of the manufacturers of approved materials shall be considered as a part of Construction Specifications and all materials shall be applied, installed, connected, erected, used, cleaned and conditioned as so called for thereby. This, however, does not remove any requirement in Construction Specifications to add to the manufacturer's recommendations.
2. All materials shall be accurately assembled, set, etc., and when so required in good construction, shall be true to line, even, square, plumb, level and regularly spaced, coursed, etc. Under no circumstances, either in new or old work, shall any material be applied over another which has not been thoroughly cleaned, sanded or otherwise treated so as not to impair the finish, adhesion, or efficiency of the next applied item.
3. All methods, procedures and results are subject to the Engineer's approval as to finished result to be obtained. However, this is not to be interpreted as placing upon the Engineer any responsibility for the "work" management which is solely the responsibility of the Contractor.

E. Joining of Work

1. The Contractor shall so schedule the work as to ensure efficient and uninterrupted progress and to hold to an absolute minimum the cutting and patching of new work. All cutting, patching and digging necessary to the execution of the work is included.
2. The Contractor shall so schedule (to include subcontracts) the construction performed by each group or trade that each installation or portion of the construction shall member with and join with all other work as required for a complete installation, all according to accepted good construction practice.

F. Superintendent

The Contractor shall keep on the work, at all times during its progress, a competent superintendent and all necessary assistants, all approved by the

Office of Budget and Finance Property Management. Prior to commencement of the work, the Contractor shall submit in writing to the Office of Budget and Finance Property Management the name and qualifications of the person to be employed as Superintendent for the execution of the Contract. A written approval or rejection will be given following review of the data. Persons who have previously proved unsatisfactory on work executed for the County, or who are without proper qualifications, will not be approved. Should the Superintendent be complained of by the Office of Budget and Finance Property Management for cause, he/she shall be removed from the work. Should it be necessary to change the Superintendent, the above procedure shall be repeated. The Superintendent will represent the Contractor. All directions given to the Superintendent shall be as binding as if given to the Contractor. Important directions shall be confirmed on written request in each case.

G. Discipline

The Contractor shall at all times enforce strict discipline and good order among his/her employees and shall not employ or permit to remain on the work any unfit person. The Contractor shall enforce all instructions relative to use of water, heat, power, no smoking, and control any use of fires, as required by law and for the Office of Budget and Finance Property Management. Employees must not be allowed to loiter on the premises before or after job working hours.

Article 22 Employment Lists

The Contractor may contact MARYLAND STATE EMPLOYMENT SERVICE, Towson, MD, 21204, if so desired, for additional labor regarding this project.

Article 23 Contractor's Supervision (Also see Article 21, Paragraph F.)

The Contractor shall constantly maintain efficient supervision of the work, using his/her best skills and coordinating ability. The Contractor shall carefully study and compare all drawings, specifications, and other instructions and check them against conditions existing or being constructed on the project. The Contractor shall report to the Engineer any error inconsistency or omission which may be discovered. (See also Article 5, Paragraph E, and Instructions to Bidders.) The Contractor shall not be held responsible for the existence or discovery of such errors or conflicts and neither shall the adjustment of such errors or conflicts be grounds for claim for extra on the art of the Contractor unless such adjustment involves work not obviously contemplated by the Contract Documents or necessary to progress of the work. The Contractor shall be responsible for the coordination of the work of all subcontractors.

Article 24 The County's Right to do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the County after three days' written notice to the Contractor may, without prejudice to any other remedy, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

Article 25 County's Right to Terminate Contract

A. Terminate Contract

The Office of Budget and Finance, Property Management, upon proof that sufficient cause exists to satisfy such action, may without prejudice to any other right or remedy, and after giving the Contractor seven (7) days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever method may be deemed expedient, if any of the following conditions exists:

1. If the contractor should
 - a. Be adjudged a bankrupt or make a general assignment for the benefit of creditors,
 - b. Has a receiver appointed on account of insolvency.
 - c. Fails to or repeatedly and persistently refuses to supply properly skilled workers or proper materials, except in cases for which extension of time is provided,
 - d. Fails to make payment to subcontractors, or for materials and labor,
 - e. Persistently disregards laws, ordinances or the instructions of the Engineer, or
 - f. Is otherwise guilty of a substantial violation of any provision of the Contract.

2. Payment Status

In cases such as identified above, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract price shall exceed the expenses of finishing the work, including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the contractor shall pay the difference to the County. The expense incurred by the County as herein provided, and the damage incurred through the Contractor's default, shall be itemized by the Engineer and a certified copy supplied to the Contractor.

Article 26 Sanitary Conveniences

- A. The Contractor shall arrange for the erection and Maintenance of temporary toilets equipped with running water and drain connection for use of employees. These conveniences shall be erected and kept clean and in good condition, as required by law, until ordered removed by the Engineer.
- B. In lieu of A. above, the Contractor may install a portable approved chemical toilet at an approved location.
- C. The permanent plumbing fixtures to be constructed under this Contract shall not be used during construction, under any circumstances.

Article 27 Subcontracts Deleted

Article 28 Relation of Contractor and Subcontractor

- A. **The Contractor agrees** to bind every subcontractor and every subcontractor agrees to be bound by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction the General Conditions*, the Drawings and Construction Specifications, as far as applicable, to his/her work, including the following provisions of this Article, unless specifically noted to the contrary in the subcontract approved in writing as adequate by the Office of Budget and Finance, Property Management.
- B. **The Subcontractor agrees** to be bound to the Contractor by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction, General Conditions*, Special Provisions, Construction Specifications, and to assume towards him/her all obligations and responsibilities that he/she, by those documents, assumes towards the County.
 - 1. To submit to the Contractor applications for payment in such reasonable times as to enable the Contractor to apply for payment under Article 8 of these *General Conditions*.
 - 2. To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in *Baltimore County's Standard Specifications for Construction and Materials* or those *General Conditions* for like claims by the Contractor upon the County, except that the time for making claims for extra cost is one (1) week.

C. **The Contractor agrees** to be bound to the Subcontractor by all the obligations the County assumes to the Contractor under Agreement, *Baltimore County's Standard Specifications for Construction and Materials, General Conditions*, Drawings and Construction Specifications, and by all the provisions thereof affording remedies and redress to the Contractor from the County.

1. To pay the Subcontractors:

- a. Upon receipt of payment, if issued under the schedule of values described in *Baltimore County's Standard Specifications for Construction and Materials, G.P.- 9.03* or Article 8 of these *General Conditions*, the amount allowed to the Contractor on account of the Subcontractor's work, to the extent of the Subcontractor's interest herein.
 - b. Upon the receipt of payment, if issued otherwise than as in Paragraph C.1., above, so that at all times the total payments shall be as large in proportion to the value of the work done by him as the total amount certified to the Contractor is to the value of the work done by him/her.
 - c. To such extent as may be provided by the Contract Documents or the subcontract, if either of these provides for earlier or larger payments than the above.
 - d. On demand for his/her work or materials as far as executed and fixed in place, less the retained percentage, at the time the payment is requested, even though the Engineer fails to approve it for any cause not the fault of the Subcontractor.
 - e. A just share of any fire insurance money received by him/her, the Contractor, under Article 35 of these *General Conditions*.
2. To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specified in the subcontract.
3. That no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim was originated.
4. To give the Subcontractor an opportunity to be present and to submit evidence in any manner involving his/her rights.

5. The Contractor and the Subcontractor agree that nothing in this Article shall create any obligation on the part of the County to pay to or to see to the payment of any sums to any Subcontractor.

Article 29 Interlocking Contracts

The attention of the Contractor and all Subcontractors is specifically called to the necessity of reading the Specifications covering items of the work which connect with or are dependent upon the work specified under each heading, and each Contractor executing the work called for there under shall be responsible for arranging for proper provision for connecting and coordinating his/her work with such other items.

Article 30 Advertising Signs

- A. The Contractor will furnish, erect and maintain a project sign for the duration of the project. The sign shall be placed on the site where and as directed by the Engineer. The sign shall be fastened to three posts spaced 4' apart. The posts shall be 4" x4", seven feet above ground and three feet below ground.
- B. The project sign is shown on page GC-27 in this book.

VII. LAWS, PERMITS, LICENSES, INSURANCE, AND BONDS

Article 31 Laws, Permits and Regulations

- A. Permit and Service Connections:
 1. **BUILDING PERMIT** - The County will obtain the building permit at no cost to the Contractor.
 2. **PERMANENT WATER SERVICE** - The County will apply for the water service and pay all related charges; i.e., water meter, water systems connection charge, water distribution charge and sewer systems connection charge. Total installation of the permanent water service is part of this Contract. Water service shall be installed by a County Prequalified Utility Contractor.
 3. **PLUMBING PERMIT** - The Contractor shall apply for the Permit; however, the County will pay all related charges and fees.
 4. **PERMANENT ELECTRIC SERVICE** - The Contractor shall apply for and pay for the electrical permit. The County shall obtain BGE permanent gas and electric service to the site at no cost to the Contractor.

The Contractor shall coordinate the installation of permanent gas and electric service with Baltimore Gas & Electric

Company. Both the gas and electric services shall be activated at the same time under one account number showing Baltimore County as owner. The Contractor shall be responsible for payment of consumption charges for the use of gas and electric energy obtained through the permanent service until the building is accepted by the County or until agreed upon by the County in direct coordination with the Building Services Division of Baltimore County. Charges from BGE for removal of existing electric service will be paid by the County.

5. **PERMANENT TELEPHONE SERVICE** - The County shall pay for the telephone service and systems to and in the building. The Contractor is responsible for supplying and installing all conduit, cables and junction boxes as shown on the drawings or called out in the Specifications.
 6. **CABLE** - The County shall pay for any cable television service into the building. The contractor is responsible for supplying and installing the remaining work as shown on the drawings and called out in the Specifications.
 7. **TEMPORARY SERVICES** -All temporary services, such as water, electric, telephone, etc., shall be the Contractor's entire responsibility. (Also see Article 46.)
 8. **MISCELLANEOUS PERMITS** - The Contractor shall procure any and all necessary permits not previously mentioned and pay any and all related charges and fees required and incidental to the due and lawful prosecution of the work.
- B. The Contractor shall give all notices and comply with all State and Federal laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Drawing and Contract Specifications are at variance therewith, he/she shall promptly notify the Engineer, in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he/she shall bear all costs arising there from.

Article 32 Compensation, Liability, and Property Damage Insurance

(See Insurance Provision in Part VI of this Contract.)

Article 33 Builder's Risk Insurance

- A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County, against loss or damage covered by

an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.

- B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

Article 34 Guaranty Bonds

- A. Prior to signing of the Contract, the Contractor will be required to furnish bond covering the faithful performance of the Contract and the payment of all obligations arising there under, in such form as the County may prescribe with such sureties as the County may approve. The premiums shall be paid by the Contractor.
- B. The Bond to be in the amount of the total Contract price.
- C. At the direction of the Office of Budget and Finance, Property Management, the Contractor may be required to increase the above bond. Such addition will be paid for by the County in the amount of actual cost to the Contractor.

Article 35 Damages

- A. If either party to this Contract should suffer damages in any manner because of the wrongful act or neglect of the other party or of anyone employed by him/her, then reimbursement shall be made by the other party for such damage.
- B. Claims under this clause shall be made in writing to the party liable within a reasonable time at the first observance of such damage and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials, and shall be adjusted by agreement.
- C. Should the Contractor cause damage to any separate contractor on the work, the Contractor agrees, upon due notice, to settle with such contractor by agreement or refer the matter to the Office of Budget and Finance, Property Management, who will render a decision after hearing all evidence in the matter. The Contractor shall pay or satisfy such decision.

VIII. INSPECTION AND SURVEYS

Article 36 Inspection

- A. If the Construction Specifications, the Engineer's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by another authority, the date fixed for such inspection. Inspections by

the Engineer shall be made promptly, and where practicable, at the source of supply. Any work covered without approval of the Engineer must, if required, be uncovered for examination at the Contractor's expense.

- B. If initial tests and/or inspections show substandard products, materials, workmanship, etc. and the Contractor elects, with the Engineer's approval, to perform additional tests and/or inspections to prove the acceptability of the substandard products, materials, workmanship etc., he/she shall perform same at his/her expense.

Article 37 Surveys

- A. The General Contractor shall, at his/her own expense, employ a registered surveyor to provide Elevation Bench Mark, and locate corners of the building and the limits of contract.
- B. The General Contractor shall, at his/her own expense, employ a competent field engineer, to give the lines and levels for the building, sidewalks and footings, etc. The Contractor will be responsible for all lines and levels and will guarantee all lines and levels as are shown on drawings.

Article 38 Unauthorized Work

Work done without lines and grades being established, work done beyond the lines and grades shown on the Plans or as established, except as herein provided, or any extra work done without written authority will be considered as unauthorized and at the expense of the Contractor and will not be measured by the Engineer, or paid for by the County. Work so done may be ordered by the Engineer to be removed and replaced at the Contractor's expense.

IX. CONSTRUCTION

Article 39 Construction Schedule

The Contractor shall hold bi-weekly "progress meetings" at the site, at a time suitable to the Engineer, at which the progress of the work shall be reported upon in detail with reference to schedules. Each interested subcontractor shall be required to have present a competent representative to report the condition of his/her branch of the work and to receive instructions. Minutes of these "progress meetings" shall be taken by the Contractor who shall type them for distribution to members of the conference, the Office of Budget and Finance, Property Management, and other interested persons. These minutes shall be received by all parties prior to the next scheduled "progress meeting."

Article 40 Protection of Work and Property

- A. All trees along the way of access shall be boxed, also all trees surrounding the building which are liable to injury by the moving, storing and working up of materials. No permanent tree shall be used for attachment of any ropes or derricks. Every public way, catch basin, conduit, tree, fence or things injured in carrying out this Contract, shall be replaced and put in good condition, unless the same shall be permanently done away with by order of the Engineer.
- B. The Contractor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hod hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling material.
- C. In an emergency affecting the safety of life, or of the work, or of the adjoining property, the contractor, without special instruction or authorization is hereby permitted to act, at his/her discretion, to prevent such threatened loss or injury, and he/she shall so act, without appeal, if so instructed or authorized. Any compensation claimed by the Contractor on account of emergency work shall be determined as outlined in Article 11.

Article 41 Shoring, Bracing and Sheeting

- A. The Contractor shall do all necessary shoring, bracing and sheeting required, or as directed by the Engineer, to carryout the work, install the foundations and other building construction, to protect the street, sidewalks and all adjoining buildings and property. He/she shall thoroughly brace and protect all earth banks sides of pits, trenches, and other excavations to prevent danger to persons or structures, and to prevent injurious cavings or erosion of any sort. Shoring and sheeting shall be removed after, or as, the walls are built and properly set.
- B. Full responsibility for both the design (by an Engineer licensed in Maryland) and the execution of all shoring, bracing, and sheeting work shall rest upon the contractor. While the Engineer shall be fully advised of all details for such work before the work itself is executed, this shall not in any way relieve the Contractor for full responsibility for all damage or expense arising from faulty installation of the said work of shoring, bracing, or sheeting.

Article 42 Tests

- A. Soils testing shall be performed by an independent testing firm arranged and paid for by the County.

- B. Materials testing shall be performed by an independent testing firm, paid for by the Contractor, which has previously been approved by the County and Architect/Engineer. Certified copies of all such test reports shall be submitted to the Engineer for approval.

Article 43 Cleaning Up

- A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his/her employees or work, and at the completion of the work, shall remove all his/her rubbish from and about the project site, and all his/her tools, scaffolding and surplus material.

In case of dispute, the County may remove the rubbish and charge the cost to the several contractors as the Engineer shall determine to be just.

- B. All debris shall be kept sprinkled to reduce dust and shall be promptly removed from the building, and no combustible materials shall be stored against perimeter walls.
- C. The Contractor shall clean entirely the building as it is completed, wash all windows, scrub all floors at least once, and leave all floors free from spots and blemishes. The interior of the building and the project area shall be left "broom clean," or its equivalent.

Article 44 As-Built Drawings

The Contractor shall, as the project progresses, neatly record on a set of white prints any changes and all revisions to the work wherever they shall differ from the Contract Drawings. Upon completion of the work, the Contractor shall turn over to the Architect this set of prints.

Article 45 Drainage and Pumping

The Contractor shall remove all water, including rain water, encountered during the entire progress of the work, using pumps, drains or other methods approved by the Engineer. Excavations and the project site shall be kept free from water until all backfilling is completed. The water shall be discharged to catch basins, or other drainage points as directed by the Engineer.

Article 46 Temporary Water, Electric and Other Services

- A. The Contractor shall arrange for and pay for the installation of temporary connection to the County's water mains, including all incidental fees and expenses for water supply during construction of the project, and shall pay for all water used. Wasting of County water will not be permitted.

- B. The Contractor shall arrange for and pay for temporary electric light and power service required during construction of the project, and shall pay for all electricity used. Gasoline or other torches for lighting will not be permitted.
- C. The Contractor shall provide and pay for any other temporary services which may be required for the satisfactory completion of the project.
- D. The Contractor shall provide, at his/her own expense, all cold weather protection, temporary heat and fuel as necessary to carry on the work expeditiously during inclement weather, to protect work and materials against injury from dampness and cold, to dry out the building and provide suitable working conditions. Refer to other sections for temperatures required for work under the various trades

The methods of heating and type of fuel and equipment used shall be subject to approval by Engineer.

With special permission, in writing, permanent heating system may be used to dry out building and provide suitable working conditions in all or various parts thereof as soon as practicable. If used, Contractor shall be responsible for use of permanent heating system for purpose described and all costs of fuel, attendance, etc. in connection therewith shall be borne by him/her. Such use shall not relieve Contractor of his/her responsibility to turn over system to Owner in perfect condition on completion of project, including the removal of all dust of construction from air handling units, etc., the replacing of all filters, etc., nor shall it shorten stipulated guarantee period which will commence upon the date of final acceptance of the work.

Article 47 Connecting to Existing Utilities

The Contractor shall, at his/her own cost and expense and as part of this work under the Contract, furnish all labor, materials, tools, and appliances, and do all work required for making connections to existing storm drains, sanitary sewer, water, gas and electric service connections, as shown on drawings, and the cost of making such connections shall be included in his/her bid.

Article 48 Existing Utilities Shown on Plans

Water mains, gas mains, storm drains, sanitary sewers, and other utilities are shown on the Plans, in accordance with the best information available, for the information of the Contractor. The County assumes no responsibility for accuracy or completeness of the information shown. Existing mains and services shall be carefully protected and any damage to them caused by the work shall be immediately repaired to the satisfaction of the Engineer by the Contractor at his own expense, using materials of the quality and kinds damaged.

X. MISCELLANEOUS ADDENDA

Article 49 Holidays

The word "holidays" used in these Contract Documents shall be taken to mean the below listed holidays, which in Baltimore County, occur as shown below:

January 1	New Year's Day
3rd Monday in January	Martin Luther King's Birthday
3rd Monday in February	President's Day
4th Monday in May	Memorial Day
June 19	Juneteenth Independence
July 4	Independence Day
1st Monday in September	Labor Day
2nd Monday in October	Indigenous Peoples' Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
December 25	Christmas
All Days of General Elections	

If any holiday occurs on Sunday, the following Monday shall be considered a holiday. If the holiday occurs on Saturday, the Friday immediately preceding shall be considered a holiday.

Article 50 Buy American Steel Act

The State of Maryland has approved House Bill No. 1659 to "Buy American Steel" for all Public Works projects in the State of Maryland, effective July 1, 1978. Compliance with Article 20.17 Metal Pipe (Page 100) and Article 20.18 Metal for Structures (Page 102) in the *S.H.A. Specifications for Materials, Highways, Bridges and Incidental Structures* dated March 1968 will satisfy this condition. Also see *Baltimore County's Standard Specifications for Construction and Materials* Section GP 7.28.

Article 51 Guarantee

- A. The Contractor guarantees all work against faulty or imperfect materials, against all imperfect or careless and/or unskilled workmanship, against all leaks and against all mechanical and electrical failure of equipment for a period of two (2) years from the date of acceptance of the project by the County. See other Sections of this Specification for other guarantees.
- B. The Contractor shall remove, replace or re-execute, without cost to the Owner, any work found to be imperfect during the guarantee period.

Article 52 Offices and Telephones

- A. The Contractor shall erect and maintain upon the project site, and where directed by the Engineer, suitable offices for his/her own use and that of the Engineer.

- B. A room of adequate size shall be provided and maintained in the Contractor's office to be used for "Progress Meetings," which frequently involve fifteen (15 or more persons). This space shall be so arranged that they can be held without interference with or from the other office or supervisory work. The room shall be 300 sq. ft. minimum and 10 ft. minimum width.

These offices shall be provided with adequate heating and lighting, all at the expense of the Contractor. In addition to the above requirements, air-conditioning will be required, the cost of which is to be included in the lump sum bid price. The system must be capable of maintaining a temperature of 80 degrees F dry bulb and approximately 50% relative humidity in the conditioned area when outside temperatures are 95 degrees F dry bulb and 78 degrees F wet bulb.

- C. The Engineer's office shall meet or exceed all requirements for a Type 1 office in accordance with *Baltimore County's Standard Specifications for Construction and Materials*, Section 103 Engineer's Office.

The Contractor shall provide telephone and FAX service in the Office of the Engineer. The Contractor shall pay all costs of installation and all charges for local and Baltimore City calls, but will not be expected to pay for long distance calls made from the Engineer's Office.



911 CENTER - TOWSON

UPS Replacement

BID DOCUMENTS

APRIL 10, 2025

OWNER

BALTIMORE COUNTY OFFICE OF BUDGET AND FINANCE
12200 LONG GREEN PIKE, GLEN ARM, MARYLAND 21057 (410) 887-3861 FAX (410) 887-4393

ARCHITECT

JOHNSON, MIRMIRAN AND THOMPSON
40 WIGHT AVENUE, HUNT VALLEY, MARYLAND 21030 (410) 372-4617

MECHANICAL, ELECTRICAL, PLUMBING ENGINEER

BURDETTE, KOEHLER, MURPHY AND ASSOCIATES
6300 BLAIR HILL LANE, BALTIMORE, MARYLAND 21209 (410) 323-0600

STRUCTURAL ENGINEER

MORABITO CONSULTANTS
952 RIDGEBROOK ROAD SUITE, SPARKS GLENCOE, MARYLAND 21152 (410) 467-2377

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NOT USED

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NOT USED

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NOT USED

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Project information.
 - 2. Type of contract.
 - 3. Access to site.
 - 4. Coordination with occupants.
 - 5. Work restrictions.
 - 6. Specification and drawing conventions.

- B. Related Requirements:

- 1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: 911 Center – UPS Replacement.

- 1. Project Location: 401 Bosley Avenue, Towson, MD 21204

- B. Owner: Baltimore County

- C. Architect: JMT Architecture

- D. Architect's Consultants: The Architect has retained design professionals who have prepared designated portions of the Contract Documents. The consultants are listed on the cover sheet of the drawings.

1.4 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than five working days in advance of proposed utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
- D. Nonsmoking Building: Smoking is not permitted on the property.
- E. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

- F. Employee Screening: Comply with Owner's requirements regarding drug and background screening of Contractor personnel working on the Project site.

- 1. Maintain list of approved screened personnel with Owner's Representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

- 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

- 3. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 4. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 5. Keynoting: Materials and products are identified by reference keynotes referencing Specification division numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Owner will issue a Change Order for signatures..

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.5 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 3. Number of Copies: Submit four opaque copies of each submittal. Architect will return one copy.
 - a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned.
 4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

- B. Preconstruction Conference: The County will schedule a Preconstruction Conference prior to issuing the Notice to Proceed (NTP).

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Construction waste management and recycling.
 - q. Parking availability.
 - r. Office, work, and storage areas.
 - s. Equipment deliveries and priorities.
 - t. First aid.
 - u. Security.
 - v. Progress cleaning.
 - w. Working hours.
3. Minutes: Record and distribute meeting minutes.

- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule

revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.8 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.

7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: CSI Form 13.2A.
1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow ten working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.

8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Division 1 Section "Submittal Procedures" for submitting schedules and reports.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. Working electronic copy of schedule file, where indicated.
 2. PDF electronic file.
 3. One paper copy of shop drawings.
 4. county standard general provisions states:
- B. Baseline Schedule
1. Within thirty (30) Days after the Award of the Contract, the Contractor shall submit to the Department a detailed baseline schedule indicating the time allocated by the Contractor for performance of each portion of the Work. The baseline schedule shall show commencement of Work from the date the Notice to Proceed is issued. The baseline schedule shall show Full and Final Completion of the Work within the Contract Time as specified in the contract or as mutually agreed upon with the County in writing pursuant to a Contract Modification after execution of the Contract.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at monthly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01330 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.

- e. Use of premises restrictions.
 - f. Seasonal variations.
 - g. Environmental control.
2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
- a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
3. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
- 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.

11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.

- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.3 DEFINITIONS

- A. Informational Submittals: Written information that does not require Architect's or Architect's approval. Submittals may be rejected for not complying with requirements of applicable sections.

1.4 SUBMITTAL PROCEDURES

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals. For a fee, cost will be \$150.00 per request. Release must be completed prior to release of digital files.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section 01320 "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal.
 - 1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor and Architect when a submittal being processed must be delayed for coordination.
 - 2. Number of Samples for Initial Selection: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product

- line. Electronic submittal of color choices is not acceptable. Architect will return submittal with options selected.
3. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, all 21 days for initial review of each.
 4. If intermediate submittals necessary, process in same manner as initial submittal.
 5. Allow 14 days for processing each resubmittal.
 6. No extension of the Contract Time will be authorized because of failure to transmit submittals in full compliance of this and related sections or enough in advance of the Work to permit processing.
- E. Identifications: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of Architect
 - d. Name and address of Contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate Specification Section
 - j. Drawing number and detail references, as appropriate
 - k. Other necessary identification
- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. The Architect will return submittals without review received from sources other than Contractor.
1. On an attached separate sheet, prepare on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
 3. Transmittal Form: Provide locations on contractor's typical transmittal form for the following information:
 - a. Project name
 - b. Date
 - c. Destination (To:)
 - d. Source (From)

- e. Names of subcontractor, manufacturer, and supplier
 - f. Category and type of submittal
 - g. Submittal purpose and description
 - h. Submittal and transmittal distribution record
 - i. Remarks
 - j. Signature of transmitter
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
 - J. Use for Construction: Use only final submittals with mark indicating action taken by architect in connection with construction.

PART 2 – PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Number of copies: Submit to architect eight copies of each submittal, unless otherwise indicated. The architect will return three copies. Mark up and retain one returned copy as a Project Record Document.
- B. Product Data. Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operating and maintenance manuals.
 - k. Compliance with recognized trade association standards.
 - l. Compliance with recognized testing agency standards.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings

- d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations
 - j. Compliance with specified standards
 - k. Notation of coordination requirements
 - l. Notation of dimensions established by field measurement.
 - 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 - 4. Number of Copies: Submit copies of each submittal, as follows: Submit to Architect eight copies of each submittal, unless otherwise indicated. The Architect will return three copies. Mark up and retain one returned copy a project Record Document.
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination"
- E. Samples: Prepare physical units of materials or products, including the following:
- 1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 - 2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - 3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials, complete units of repetitively used materials; swatches showing color, texture, and pattern' color range sets; and components used for independent testing and inspection.
 - 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's same where so indicated. Attach label on unexposed side that includes the following:
 - a. Generic description of Sample
 - b. Product name or name of manufacturer.
 - c. Sample source
 - 5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
 - a. Size limitations
 - b. Compliance with recognized standards
 - c. Availability
 - d. Delivery time
 - 6. Submit samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.

- b. Refer to individual Specification sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
- 7. Number of Samples for Initial Selection: submit three full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. The Architect will return submittal with options selected.
- 8. Number of Samples for Verification: Submit three sets of Samples. The Architect will retain two.
 - a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
- 9. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product.
 - 2. Number and name of room or space.
 - 3. Location within room or space.
- G. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."
- H. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. The Architect will not return copies.
 - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- K. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- L. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.

- O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Sections "Closeout Procedures and "Operation and Maintenance Data."
- P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- T. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: The architect will not review submittals that do not bear Contractor's approval stamp and will return them without action after noting date originally received and returned.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it to the Architect. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. Final Unrestricted Release: When the Architect marks a submittal "No Exceptions Taken," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 - 2. Final-But-Restricted Release: When the Architect marks a submittal "Make Changes Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 - 3. Returned for Resubmittal: When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
 - a. Do not use, or allow others to use, submittals marked "Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
 - 4. Rejected: When architect marks submittal "rejected," submittal material is in noncompliance with the contract documents. Prepare new submittal in accordance with the contract documents.
 - 5. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."
- C. Informational Submittals: Architect will review each submittal and return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to the Architect.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Quality Assurance and Quality Control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged by the Contractor to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 SUBMITTALS

- A. Quality Control Plan: Submit a Contractor's Quality Control Plan within 15 days of Notice to Proceed. At a minimum it shall contain procedures for review and acceptance of this site prior to the start of specific items of work; review and approval of completed items of work for compliance with the contract documents; review, approval and management of submittals; identification, recordation and tracking of rework items.

- B. Contractor's Daily Construction Reports: Compile and submit weekly, by the end of the first working day following the week of the work covered by the reports.
- C. Rework Items List: Compile, update and submit weekly, by the end of the first working day following the week of the work covered by the reports. The contractor shall maintain a list of work that does not comply with the Contract, identifying what times need to be reworked, the date the item was originally discovered and the date the item was corrected.
- D. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- G. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Ambient conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- H. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
 - d. When testing is complete, remove assemblies; do not reuse materials on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Program Manager with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Program Manager.
2. Notify Program Manager seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's and Program Manager's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

- A. Owner Responsibilities: The Contractor is responsible for obtaining and providing all testing services. The Owner shall pay for these services as part of the monthly Applications for payment per a separate line item in the construction cost breakdown.
 1. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be the responsibility of the Contractor.
- B. Contractor Responsibilities: Unless otherwise indicated, provide all testing and quality-control services specified and required by authorities having jurisdiction.
 1. Engage a qualified testing agency to perform these quality-control services.
 2. Notify testing agencies and Owner at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Special Tests and Inspections: Contractor will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
 1. Testing agency will notify Owner and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Owner with copy to Contractor and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and reinspect corrected work.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide at Contractor's cost quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 5. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field-curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 15 days of date established for the Notice To Proceed.
1. Distribution: Distribute schedule to Owner, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
 2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. The Courts building as a whole must maintain security and a clean environment for those working in the building and for those visiting the building. The 911 Center and the server room are “mission critical” components for the safety of the residents of Baltimore County and therefore must be protected during construction at all costs. Coordination and communication between the Contractor and the Owner must be maintained to ensure that a safe environment and functionality is maintained.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner.. Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste-handling procedures.
 - 5. Other dust-control measures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
 - 1. Methods used to meet the goals and requirements of the Owner.
 - 2. Concrete cutting method(s) to be used.
 - 3. Location of construction devices on the site.
 - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 - 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches (914 by 1524 mm).

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading may be furnished at the discretion of the Contractor. Its placement on the site or on the surrounding streets must be approved by the County.
 - 1. The County will provide a space to house meetings for the project.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- C. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- D. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
1. Connect temporary service to Owner's existing power source, as directed by Owner.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- G. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
- H. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- B. Parking: Provide temporary offsite parking areas for construction personnel.
- C. Storage and Staging: Provide temporary offsite area for storage and staging needs.
- D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- E. Project Signs: Provide Project signs. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs per design and size as provided by the Owner.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touch up signs, so they are legible at all times.
- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 1 Section "Execution."

- G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- H. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.
- I. Existing Elevator Usage: Use of the existing elevators may be permitted by the Owner on an "after hours" basis so that the occupants of the building are not impacted.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Comply with requirements specified in Division 1 Section "Temporary Tree and Plant Protection."
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

- G. Site Enclosure: Before construction operations begin, furnish and install site enclosure in a manner that will prevent people from easily entering site except by entrance doors..
 - 1. Extent of Enclosure: Portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - 3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 4. Provide walk-off mats at each entrance through temporary partition.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

3.7 SITE USAGE AND STAGING

- A. The site is very restrictive in access and use of the premises for storage of materials and staging. For the most part, the Contractor shall schedule material delivery on a daily basis for immediate installation. Materials may not be stored within the building where it would impact the occupants of the building and/or the function of the 911 Center.
 - 1. The contractor shall identify a proposed area to stage and store materials and obtain approval from the County.

END OF SECTION 015000

SECTION 015731 - INDOOR AIR QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Special requirements for Indoor Air Quality (IAQ) management during construction operations.
 - a. Control of emissions during construction.
- B. Related Sections:
 - 1. Division 1 Section "Submittal Procedures" for required submittal procedures.
 - 2. Division 1 Section "Temporary Facilities and Controls" requirements for installation, maintenance and removal of temporary utilities, controls, and facilities during construction.
 - 3. Division 1 Section "Product Requirements" procedures for storage of interior materials to prevent exposure to moisture and pollutants.
 - 4. Division 23 Section "Basic Mechanical Materials and Methods" for duct cleaning procedures.

1.3 IAQ MANAGEMENT STRATEGY

- A. The OWNER has established that the contractor shall prevent indoor air quality problems resulting from the construction process, to sustain long term installer and occupant health and comfort.
- B. Protect the ventilation system components during construction and clean contaminated components after construction is complete.
- C. Control sources of potential IAQ pollutants by controlling selection of materials and processes used in project construction.

1.4 REFERENCES

- A. Definitions: Definitions pertaining to sustainable development: As defined in ASTM E 2114.
1. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
 2. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261.
 - a. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
 3. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.
 4. Interior Final Finishes: Materials and products that will be exposed at interior, occupied spaces; including flooring, wallcovering, finish carpentry, ceilings, and sealants.
 5. Packaged Dry Products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
 6. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preconstruction Conference: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Construction Manager, and Architect to discuss the proposed IAQ Management Plan and to develop mutual understanding relative to details of environmental protection.

1.6 SUBMITTALS

- A. Indoor Air Quality (IAQ) Management Plan: Prepare and submit an IAQ Management Plan including, but not limited to, the following:
 - 1. Procedures for control of emissions during construction.
 - a. Identify schedule for application of interior finishes.
 - 2. Procedures for moisture control during construction.
 - a. Identify porous materials and absorptive materials.
 - b. Identify schedule for inspection of stored and installed absorptive materials.
 - 3. Revise and resubmit Plan as required by the Owner.
 - a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Photographs documenting construction IAQ management measures implemented during construction such as duct protection measures and measures to protect on-site stored or installed absorptive materials from moisture.
- C. Cut sheets of filtration media used during construction with MERV values highlighted.
- D. Product Data:
 - 1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
 - 2. Submit air pressure difference maps for each mode of operation of HVAC.
 - 3. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products.
 - a. Adhesives
 - b. Floor and wall patching/leveling materials
 - c. Caulking and sealants
 - d. Insulating materials
 - e. Fireproofing and firestopping
 - f. Carpet
 - g. Paint
 - h. Clear finish for wood surfaces
 - i. Lubricants
 - j. Cleaning products

PART 2 – PRODUCTS

2.1 GENERAL ENVIRONMENTAL ISSUES

- A. Mold and Mildew: Materials that have evidence of growth of molds or mildew are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.
- B. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.

2.2 AIR FILTRATION MEDIA

- A. Minimum Efficiency Reporting Value (MERV) as determined by ASHRAE 52.2-2007:
 - 1. MERV-8 for filtration media used at each return air grill, if used during construction.
 - 2. MERV-13, for filtration media installed at the end of construction and prior to occupancy.

2.3 CLEANING PRODUCTS

- A. Use low-toxic and lowest-emitting spot removers and cleaning agents for surfaces, equipment, and workers' personal use.
- B. Use HEPA-filter equipped vacuum cleaners for the final cleaning.

PART 3 – EXECUTION

3.1 IAQ MANAGEMENT – EMISSIONS CONTROL

- A. During construction operations, follow the recommendations in SMACNA "IAQ Guidelines for Occupied Buildings under Construction."
- B. HVAC Protection:
 - 1. Fit all return air grilles with temporary filters with a Minimum Efficiency Reporting Value (MERV) of 8.
 - 2. Isolate the return side of the HVAC system from the surrounding environment as much as possible (e.g., place all tiles for the ceiling plenum, repair all ducts and air handler leaks).
 - 3. Damper off the return system in the heaviest work areas and seal the return system openings with plastic.
 - 4. Provide temporary exhaust during construction operations

5. Upgrade the filter efficiency where major loading is expected to affect operating HVAC system.
 6. Clean permanent return air ductwork per National Air Duct Cleaning Association standards upon completion of all construction and finish installation work.
 7. Replace all filtration media prior to occupancy.
- C. Source Control:
1. Provide low and zero VOC materials as specified.
 2. Do not use products in combination with or in contact with other products that can be identified as combining to form toxic fumes or sustained odors.
- D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.
1. Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.
 2. Erect barriers between work areas or between the inside and outside of the building to prevent unwanted airflow from dirty to clean areas.
- E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.
- F. Temporary Ventilation: Provide an ACH (air changes per hour) of 1.5 or more and as follows:
1. Provide minimum 48-hour pre-ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 deg F minimum to 90 deg F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by Architect.
 2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
 3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction and during OWNER occupancy. Coordinate with Work of Division 23, Heating, Ventilating, and Air Conditioning (HVAC).
 - a. Replace filters during construction as necessary to protect equipment and indoor air quality.
- G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.

1. Do not use solvents within interior areas that may penetrate and be retained in absorptive materials such as concrete, gypsum board, wood, cellulose products, fibrous material, and textiles.

3.2 IAQ MANAGEMENT – IMPLEMENTATION OF PLAN

- A. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing the IAQ Management Plan for the Project.
 1. Report all issues to General Contractor for immediate correction.
- B. Progress Meetings: Construction related IAQ procedures shall be included in the pre- construction and construction progress meeting agendas.
- C. Distribution: The Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the OWNER, and the Architect.
- D. Instruction: The Contractor shall provide on-site instruction of the IAQ procedures and ensure that all participants in the construction process understand the importance of the goals of the IAQ Management Plan.
- E. Verification: Project Manager to fill out the Construction IAQ Management Plan Inspection Checklist with photographs of the measures in place during weekly site visits.
- F. On-site Check-in Procedures: General Contractor and Sub Contractor to review and agree on specified products and VOC limits before Sub Contractor begins work using the VOC Verification Checklist.

END OF SECTION 015731

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Division 1 Section "References" for applicable industry standards for products specified.
 - 2. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
 - 3. Divisions 2 through 27 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

- D. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

- A. **Product List:** Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
 - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 - 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 - 3. Initial Submittal: Within 14 calendar days after the Notice to Proceed (NTP), submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 - 4. Completed List: Within 28 calendar days after the Notice to Proceed (NTP), submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - 5. Design Consultant Action: The Design Consultant will respond in writing to Contractor 14 calendar days of receipt of completed product list. The Design Consultant's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. The Design Consultant's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. **Substitution Requests:** Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Design Consultant Action: If necessary, the Design Consultant will request additional information or documentation for evaluation within 7 calendar days of receipt of a request for substitution. The Design Consultant will notify Contractor of acceptance or rejection of proposed substitution within 15 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Design Consultant Action: If necessary, the Design Consultant will request additional information or documentation for evaluation within 7 calendar days of receipt of a comparable product request. The Design Consultant will notify Contractor of approval or rejection of proposed comparable product request within 15 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
- a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
 - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.
- 1.5 QUALITY ASSURANCE
- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Store cementitious products and materials on elevated platforms.
 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 7. Protect stored products from damage and liquids from freezing.
 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.
 9. Materials paid by Owner and stored off-site, the items must be stored in a bonded storage facility and insured with the Owner named as the insured. If the material is to be located beyond 25 miles of the construction site the contractor must provide transportation for the Owners representative to visit the storage site for material verification. Materials must be clearly marked as property of the Owner, including project name.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 - 3. Refer to Divisions 2 through 27 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," the Design Consultant will make selection.
 - 5. Where products are accompanied by the term "match sample," sample to be matched is the Design Consultant's.
 - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 - 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 - 3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - 4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 - 5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 - 6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements.

- Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
 8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
 9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
 10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: The Contractor may submit substitutions anytime within a 45 calendar day period after Notice to Proceed. Substitutions will be considered and reviewed by the Design Consultant who will make an acceptance or rejection recommendation to the Owner. The burden of proof of equivalency rests with the Contractor and evidence of such equivalency shall be submitted to the Design Consultant.
- B. Conditions: The Design Consultant will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, the Design Consultant will return requests without action, except to record noncompliance with these requirements:
 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.

10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Conditions: The Design Consultant will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, the Design Consultant will return requests without action, except to record noncompliance with these requirements:
 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. General installation of products.
 - 2. Progress cleaning.
 - 3. Starting and adjusting.
 - 4. Protection of installed construction.
 - 5. Correction of the Work.

1.3 SUBMITTALS

- A. Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence, location and applicable characteristics of all mechanical, electrical, and utility systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
1. Provide location services as required to accurately locate all utilities and systems that may affect or be affected by the work.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed. This includes compatibility with all proposed hangers and support structures.
 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner in writing not less than 15 days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements, dimensions and points of connection of items shown diagrammatically on Drawings.

- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a Request For Information to the Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

- B. Site: Maintain Project free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper and safe execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper and safe execution of the Work, broom-clean, wet mop or vacuum the entire work area, as appropriate.
 - 3. Remove and/or secure all loose overhead debris and materials that pose a threat to safety.
 - 4. The Contactor is responsible for protection of all existing furnishings, equipment and fixtures remaining in work areas. Floors must be covered with a protective layer of cardboard, plywood or other equally protective product. Furnishings, equipment and fixtures remaining in the space must be covered and protected from damage and dust accumulation. Contractor must prevent the spread of dust and debris to adjacent non-work areas.
- D. Installed Work: Keep installed work clean and free from damage. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
 - 2. Patch all abandoned holes with proper methods and materials.
 - 3. Apply temporary patching as may be necessary to ensure safe usage as befits an occupied building under construction situation.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing any waste materials down sanitary or storm sewers or into waterways will not be permitted.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section 01400 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration during the course of construction and at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

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SECTION 017310 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
 - 2. Divisions 2 through 28 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 23 and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-protection systems.
 - 4. Control systems.
 - 5. Communication systems.
 - 6. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Exterior curtain-wall construction.
 - 4. Equipment supports.
 - 5. Piping, ductwork, vessels, and equipment.
 - 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - 1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.

- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas during school hours.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete, Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 017310

SECTION 017320 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for use of premises.
 - 2. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 3. Division 1 Section "Cutting and Patching" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Locations of proposed dust- and noise-control temporary partitions and means of egress.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 6. Means of protection for items to remain and items in path of waste removal from building.

- B. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
 - 1. Comply with requirements specified in Division 1 Section "Summary."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Hazardous materials are not present in the building.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 4. Maintain adequate ventilation when using cutting torches.
 - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 7. Dispose of demolished items and materials promptly.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 017320

SECTION 017410 - WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the period for correction of the Work.
 - 2. The minimum period of warranty shall be two years.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
 - 2. Division 1 Section "Contract Closeout" specifies contract closeout procedures.
 - 3. Divisions 2 through 28 Sections for specific requirements for warranties on products and installations specified to be warranted.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor

is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Prime Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.
- B. When the Contract Documents require the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
- C. Refer to Divisions 2 through 28 Sections for specific content requirements and particular requirements for submitting special warranties.
- D. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 - 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Prime Contractor.
 - 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017410

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes requirements for waste reduction and for the recycling of non-hazardous, recyclable, construction and demolition debris.
 - 1. Reduce waste by minimizing factors that contribute to waste.
 - 2. Use reasonable and legal means to divert a minimum of 75% of construction and demolition debris from landfills and incinerators through at least 3 waste diversion streams by facilitating their recycling or reuse through a construction waste management program.

1.2 DEFINITIONS

- A. Waste Reduction: Construction practices that achieve the most efficient use of resources and materials; uses water efficiently; avoids practices such as over-packaging, improper storage, ordering errors, poor planning, breakage, mishandling and contamination.
- B. Construction and Demolition Debris: Solid wastes arising from demolition or removal, excess or unusable construction materials, packing materials for construction products, and other materials generated on site during the construction process but not incorporated into the Work.
- C. Recyclable Materials: Construction and demolition debris that can be recovered and processed into new products or materials. Recyclable materials include, but are not limited to, the following:
 - 1. Metals: Ferrous (iron, steel, stainless steel, galvanized steel) and non-ferrous (copper, brass, bronze, aluminum) types and containers made from metals such as pails, buckets, and beverage cans.
 - 2. Asphaltic concrete paving.
 - 3. Concrete.
 - 4. Gypsum wallboard.
 - 5. Paper products such as generated from field office activities and clean corrugated packaging cardboard.
 - 6. Wood products, including untreated dimensional lumber, plywood, oriented strand board, hardboard, particleboard, and crates and pallets made from wood products.
 - 7. Brick and stone masonry.
 - 8. Carpet and padding.
 - 9. Plastics and containers made from plastics such as pails, buckets, and beverage bottles.

10. Copper wiring.
11. Glass: Glass beverage containers, window and mirror glass.
12. Clean and uncontaminated, excavated soils not intended for other on-site use.
13. Stumps and tress removed as a part of land clearing operations.

NOTE: excavated soils, stumps and trees removed as a part of land clearing cannot be included in the LEED MRc2 calculations.

NOTE: Alternative Daily Cover does not qualify.

- D. Non- Recyclable Materials: Construction and demolition debris not capable of being reused or reprocessed, exclusive of the recyclable materials listed above.
- E. Hazardous Materials: Construction and demolition debris that are regulated for disposal by local, city, county, state, or Federal authorities.
- F. Waste Diversion Stream: A waste stream is a distinct end use that has diverted material from disposal.

1.3 SUBMITTALS

- A. Construction Waste Management Program: Submit the proposed waste management program appended to the bid. The program shall include the following:
 1. Identification of Contractor's staff responsible for enforcing construction waste management.
 2. Actions that will be taken to reduce solid waste generation.
 3. Description of the specific methods to be used in recycling/reuse of the various construction and demolition debris generated, including the areas and equipment, to be used for processing, sorting, and temporary storage of debris.
 4. Characterization, including estimated types and quantities of the construction and demolition debris to be generated. Include percentage of recyclable and non-recyclable debris.
 5. List of specific construction and demolition debris materials that will be salvaged for resale, salvaged and reused, or recycled.
 6. Name(s) of landfill and incinerator to be used and the estimated costs for use, for construction and demolition debris that is unable to be recycled or reused.
 7. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used and excess construction materials such as materials exchange networks and Habitat for Humanity.
 8. Identification of local recycling facilities that will accept construction and demolition debris.
 9. Identification of constructions and demolition debris that cannot be recycled/reused with an explanation or justification.
 10. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue

generated by sale of the construction and demolition debris and avoided landfill and incineration costs.

- B. Waste Management Reports: With each Application for Payment, submit a Waste Management Report in a form acceptable to the Owner. Attach manifests, weight tickets, receipts and invoices. Organize and maintain records to document the following:
 - 1. Quantity of debris generated, for each material recycled, reused or salvaged.
 - 2. Quantity of debris diverted through sale, reuse, or recycling, in tons or cubic yards.
 - 3. Quantity of debris disposed by landfill or incineration.
 - 4. Name and location of each firm accepting the debris, including:
 - a. Types of debris accepted.
 - b. Date of acceptance.
 - 5. Transportation cost for removal of debris from job site.
 - 6. Amount of money paid or received for the recycled, reused, or salvaged materials.
 - 7. Net total cost or saving recycling, reusing or salvaging materials.
- C. Project Closeout: Upon project completion submit the Waste Management Records to the Owner.
 - 1. Submit evident that non-hazardous construction and demolition has been recycled and salvaged. Calculations can be done by weight or volume, but must be consistent throughout.

1.4 QUALITY ASSURANCE

- A. Construction Waste Management: Prior to bid, prepare a program that minimizes waste and diverts construction and demolition debris from landfills and incinerators by facilitating their reuse or recycling. Name the waste material processors who will accept the construction and demolition debris, the condition of the construction and demolition debris required by the waste material processors, the method proposed to provide the construction and demolition debris in suitable condition and in a quantity acceptable to the disposal sites and waste material processors whom will receive them, and the impact on the project schedule. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to the recycling of waste. Revenues or other savings obtained from sale, reuse, and recycling operations shall accrue to the Contractor.
- B. Disposal Sites and Waste Material Processors: Use only facilities with valid legal permits for disposal, recycling and waste processing issued by the jurisdictions in which they are located.
- C. Pre-Construction Waste Management Meeting: Prior to beginning site preparation, schedule and conduct a meeting to review the waste management program. The

meeting shall include the Contractor, the Architect, the Owner and any of the Contractor's subcontractors or suppliers whose work will interface with the program. The agenda shall include a discussion of procedures, schedules and specific requirements for construction and demolition debris, sale, reuse, recycling, and disposal. Make any revisions to the program that are agreed to as a part of the meeting and submit the revised program and the meeting minutes to the Architect and Owner for their records.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the architect.
- B. General: For the duration of the project implement and maintain construction waste management. During the prosecution of the Work encourage the practice of efficient waste reduction when sizing, cutting, and installing products and materials.
- C. Transportation: Arrange for the regular collection, transport from the site, and delivery of the construction wastes and debris to the designated recyclers, and waste material processors and disposal sites.
- D. Separation Facilities: The Contractor shall provide on-site instruction of appropriate separation, handling separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the Project. Provide and designate an on-site area for the separation of construction and demolition debris for reuse and recycling. Locate the area in order that non-recyclable debris will not contaminate materials to be reused or recycled. Provide containers and bins in the designated area to facilitate separation, storage and handling which are clearly and appropriately marked. Cut all items to lengths and sizes to fit within the containers or bins provided. Where there is sufficient quantity of a specific recyclable debris item (for example; salvaged metal doors and frames or duct work), make arrangements for items to be bundled, banded or tied, and stack in a designated location for a special pick-up. Maintain the separation facilities in an orderly condition to prevent contamination of materials placed therein and to maximize reuse and recyclability of debris. Separate construction and demolition debris at the project site by one of the following methods:
 - 1. Source Separated Method: Construction and demolition debris, that is reusable and recyclable, are separated from non-recyclable debris and sorted into appropriately marked separated containers or bins and then transported to the designated recycling facility for further processing. Non-recyclable debris is transported to a landfill or incinerator.
 - 2. Co-Mingled Method: All construction and demolition debris is placed into containers or bins and then transported to a recycling facility where recyclable and salvageable materials are removed, sorted, and processed and the remaining waste is transported to a landfill or incinerator.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Record Documents.
 - 3. Operation and maintenance manuals.
 - 4. Warranties.
 - 5. Instruction of Owner's personnel.
 - 6. Final cleaning.
- B. Related Sections:
 - 1. Division 1 Section "Warranties" for warranty requirements.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 4. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 6. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 7. Complete startup testing of systems.
 - 8. Submit test/adjust/balance records.
 - 9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 10. Advise Owner of changeover in heat, gas, electric and other utilities.
 - 11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance/
 - 12. Complete final cleaning requirements, including touchup painting.
 - 13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect

will prepare the Certificate of Substantial Completion after inspection or Architect will notify Contractor of items, either on Contractor's list or additional items identified that must be completed or corrected before certificate will be issued.

1. The Architect will conduct inspections for certification of Substantial Completion and certification of Final Acceptance concurrently.
2. The Architect shall prepare a list of incomplete or incorrect work and transmit the list to the Contractor.
3. Upon completion or correction of the work the Contractor shall so certify by returning a signed copy of the list of completed work to the Architect.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section 01290 "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. The Architect will review a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected. If the Architect is required to reinspect the work after inspection indicated in article 1.3,B,1, he may be entitled to extra compensation, the cost of which to the Owner may be charged to the Contractor.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.6 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Program Manager's and Architect's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 - 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 - 5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Note related Change Orders, Record Drawings, where applicable.
- D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Drawings where applicable.
- E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
 - 1. Operation Data:
 - a. Emergency instructions and procedures.
 - b. System, subsystem, and equipment descriptions, including operating standards.
 - c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 - d. Description of controls and sequence of operations.
 - e. Piping diagrams.
 - 2. Maintenance Data:
 - a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures.
 - d. Maintenance and service schedules for preventive and routine maintenance.
 - e. Maintenance record forms.
 - f. Sources of spare parts and maintenance materials.
 - g. Copies of maintenance service agreements.
 - h. Copies of warranties and bonds.
- B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.2 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Seed and sod damaged grassy areas and rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean surfaces not part of construction but that have been soiled or dirtied due to construction activities.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - n. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - o. Replace parts subject to unusual operating conditions.
 - p. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - q. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - r. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - s. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - t. Leave Project clean and ready for continued occupancy.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

- A. Initial Submittal: Submit 1 draft copies of each manual at least 7 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Program Manager will return copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit 3 copies of each manual in final form.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:

1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

- a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
6. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation Including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training videotape, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow any required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and Maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams.

Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section 01781 "Project Record Documents."
- G. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Submittal: Submit one set of marked-up Record Prints. Architect will review and note whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return prints for organizing into sets, printing, binding, and final submittal.
- B. Record Specifications: Submit one copy of marked-up Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

- b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
- 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically
- 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect and Architect.
 - 1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 - 2. Refer instances of uncertainty to Program Manager for resolution.
 - 3. Print the Contract Drawings and Shop Drawings for use as Record Transparencies.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - 2. Consult with Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- C. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 – DEMONSTRATION AND TRAINING

PART I - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Project Management and Coordination" for requirements for preconstruction conferences.

1.3 SUBMITTALS

- A. Instruction Program: Submit three copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. At completion of training, submit three complete training manuals for Owner's use.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
- E. Demonstration and Training DVD: Submit two copies at end of each training module.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section 01400 "Quality Requirements," experienced in operation and maintenance procedures and training.

- C. Preconstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - 1. Equipment.
 - 2. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
 - 3. Intrusion detection systems.
 - 4. Heat generation, including boilers, feedwater equipment pumps, steam distribution piping and water distribution piping.
 - 5. Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
 - 6. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
 - 7. HVAC instrumentation and controls.
 - 8. Electrical service and distribution, including transformers, switchboards, panelboards and motor controls.
 - 9. Lighting equipment and controls.
 - 10. Communication systems, including intercommunication clocks and programming, voice and data and television equipment.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.

- b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:

- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Demonstration and Training DVD: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 033053 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Action Submittal:
 - 1. Design Mixtures: For each concrete mixture.

1.3 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASSTM C 94 requirements for production facilities and equipment.
- B. Comply with ACI 301.
- C. Comply with ACI 117, “Specifications for Tolerance for Concrete Construction and Materials.”

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain and Welded Wire Reinforcement: ASTM A 1064, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand and source throughout Project:
 - 1. Portland Cement: ASTM C 150, [Type I], [Type II], [Type I/II], [Type III], [Type V]. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Blended Hydraulic Cement: ASTM C 595; Type IS, Portland blast-furnace slag; Type IP, Portland-pozzolan; Type I (PM), pozzolan-modified Portland; type I (SM0), slag-modified Portland cement.

- B. Normal-Weight Aggregate: ASTM C 33, graded, 1 ½ inch nominal maximum aggregate size.
- C. Water: ASTM C94.
- D. Synthetic Fiber: [Monofilament] [or] [fibrillated] polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, [½ to 1 ½ inches].

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 44, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494 Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
 - 7. Non-Set-Accelerating Corrosion Inhibitor Admixture: Mixed inhibitor
 - 8. Set-Accelerating Corrosion Inhibitor Admixture: ASTM C 494, Type C, 30% calcium nitrite.

2.5 RELATED MATERIALS

- A. Vapor Retarder: Plastic Sheet, ASTM E 1745, Class A or B.
- B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork, or self-expanding cork.

2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B compatible with specified floor finishes.
- F. Clear, Waterborne or Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 CONCRETE MIXTURES

- A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:
 - 1. Minimum Compressive Strength: 3000 psi (except as otherwise noted); 3500 psi (exterior concrete) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: [0.50] [0.45].
 - 3. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than 40 percent.

- 4. Slump Limit: 4 inches, 5 inches, 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
- 5. Air Content: ASTM C-260; Air content $6\% \pm 1\%$. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.
- B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommend rate but not less than a rate of 4.0 lb./cu. yd.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information.
 - 1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

- A. Install, protect, and repair vapor retarders according to ASTM E 1643, place sheets in position with longest dimension parallel with direction of pour.
 - 1. Lap joints 6 inches and seal with manufacturers recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-On-Grade: Form weakened-plane sawed contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness.
- C. Isolations Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.6 CONCRETE PLACEMENT

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment.

3.7 FINISHING FORMED SURFACES

- A. Rough-formed finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ½ inch.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed finished as-cast concrete where indicated:
 - 1. Grout-cleaned finish.
 - 2. Smooth-rubbed finish.
 - 3. Cork-floated finish.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleed-water appears on surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes, unless otherwise indicated.
- D. Float Finish: Apply float finish to surface indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Nonslip Broom Finish: Apply a non-slip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb. / sq. ft. x h before and during finishing operations. Apply according to manufactures written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water
 - b. Continuous water-fog spray
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301.
 - 1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 50 cu. yd., plus one set for each additional 100 cu. yd. or fraction thereof.

3.11 CONCRETE SURFACE REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.

- B. Repair method, products and procedures shall be submitted and approved prior to commencement of work.

END OF SECTION 033053

SECTION 050519 – POST-INSTALLED ANCHORS IN CONCRETE & MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Furnish all work, labor, materials, equipment, and supervision necessary to provide and install anchors in previously poured concrete and in masonry as indicated on Structural Drawings, as specified herein, or as otherwise required to anchor or support materials and equipment from structure.

B. Work Not Included:

1. Anchors, embeds, and other materials placed prior to concrete pour, cast into concrete, or set in masonry walls – See Section Divisions 3, 4, and 5.
2. Concrete reinforcing steel – See Section 032000.

1.2 QUALITY ASSURANCE

A. Applicable Specifications: Latest edition of the following documents shall become part of this specification as if written herein. Whenever requirements conflict, the more stringent shall govern.

1. ACI 318
2. Mechanical Anchors: ACI 355.2, “Qualification of Post-Installed Mechanical Anchors in Concrete.”
3. Adhesive Anchors: ACI 355.4, “Qualification of Post-Installed Adhesive Anchors in Concrete.”
4. Expansion and Screw Anchors (Concrete): ICC-ES AC193.
5. Expansion Anchors (Masonry) ICC-ES AC01.
6. Screw Anchors (Masonry) ICC-ES AC106.
7. Adhesive Anchors: ACI 355.4, “Qualification of Post-Installed Adhesive Anchors in Concrete.”
8. Adhesive Anchors (Concrete) ICC-ES AC308.
9. Adhesive Anchors (Masonry) ICC-ES AC58.
10. Manufacturer’s published specifications and installation requirements.

B. References:

1. CRSI (Concrete Reinforcing Steel Institute) CTN-M-3-11: Suggested General Drawing Notes for Adhesive Anchors.
2. CAMA (Concrete Anchor Manufacturers Association): Special Inspection Guidelines for Post-Installed Anchors.
3. ACI-CRSI CP80-12 Installer Workbook: Certification Program for Adhesive Anchor Installer.

C. All post-installed anchors in concrete shall have current published ICC-ES Evaluation Report indicating the anchor is approved for installation in cracked concrete as required by ACI 355.4.

D. Where material or equipment must be supported from the structure, the installer of the material of equipment support shall be responsible for supplying the anchors and meeting the requirements of this specification unless specifically noted otherwise on the plans.

E. Installer Qualification: Adhesive Anchor Installer shall meet the requirements of paragraphs 1.2.B.2 & 1.2.B.3 above.

1. Drilled-in anchors shall be installed by a contractor with at least three years of experience performing similar installations.
2. Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads (as determined by the Engineer) shall be performed by personnel certified by the ACI-CRSI “Adhesive Anchor Installer Certification Program.”

3. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the contractor on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
 - a. Hole drilling procedure
 - b. Hole preparation and cleaning technique
 - c. Adhesive injection technique and dispenser training / maintenance
 - d. Proof loading / torquing
- F. Field and laboratory testing of all post installed anchors shall comply with the testing requirements of Section 014000, Quality Control. Perform all specified inspections and tests in accordance with ACI 301 and IBC. Testing Agency shall meet the requirements of ASTM E 329. Special inspection shall be in accordance with a current published ICC-ES Evaluation Report.
 1. Field and laboratory testing costs and coordination shall be the responsibility of the Contractor.
- G. Certifications: Unless otherwise authorized by the Engineer, all anchors shall have an ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.3 SUBMITTALS

- A. An ICC-ES Evaluation Service Report shall be submitted for anchors that will be considered for use on this project.
 1. Anchors specifically referenced by the structural plans or specifications shall have the Evaluation Service Reports provided with a cover letter indicating the applicable notes and/or details for each anchor (unless noted otherwise).
 2. Anchors not specifically referenced by the structural plans or specifications shall have the Evaluation Service Reports submitted with the associated justification.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Structural design criteria.
 2. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion, and undercut anchors.
 3. Samples: Representative length and diameters of each type of anchor shown on the Drawings.
 4. Quality Assurance Submittals:
 - a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - b. Certificates: ICC ES Evaluation Reports
 5. Preparation instruction and recommendations.
 6. Manufacturer's installation instructions.
 7. Storage and handling requirements and recommendations.
 8. Installation Qualifications & Procedures: Submit installer qualifications as stated in Section 12.E. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
- C. Preliminary proposals for substitutions to specified anchors must be submitted to the A/E/Engineer in a timely fashion so that the project is not delayed.
 1. The Engineer or A/E may reject proposed substitutions for aesthetics, interference, inappropriate materials, fire ratings, or any other reason.
 2. If the preliminary proposal for substitutions is approved, the contractor must make a final substitution submittal in conformance with the "SUBSTITUTIONS" section included in this specification.
- D. Calculations shall be submitted for all anchors and anchor groups that are shown but are not completely detailed on the structural drawings. Calculations shall be reviewed for general conformance with the design

intent and shall be submitted to the Engineer for record only. Calculations must be submitted to the State when required for a component submittal.

1. Calculations are required to be submitted:
 - a. Where design loads are shown on structural documents in lieu of completely detailed anchor information.
 - b. When a proprietary anchor is shown on the plans and a different anchor is substituted.
2. Calculations are not required to be submitted to the A/E:
 - a. Where anchor size, length or embed length, spacing, and a proprietary trade name are specifically shown on the structural plans.
 - b. For anchors used by other trades but are not shown on the structural plans, including hangers for piping, mechanical equipment, electrical raceways, etc. the equipment supplier remains responsible for the proper anchor design.

E. Installer Certifications

1. Submit record of ACI-CRSI “Adhesive Anchor Installer Certification Program” certifications for all proposed personnel who will be installing adhesive anchors in a horizontally or upwardly inclined position, which support sustained tension loads.

F. Closeout Submittals: Submit the following:

1. Record Documents: Project record documents for installed materials in accordance with Division a Closeout Submittals Section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store anchors in accordance with manufacturer’s recommendations. For adhesive anchors, consider temperature, exposure to sunlight, and shelf life.

1.5 SUBSTITUTIONS

- A. Anchors included in this specification, but not shown in a specific detail, may be considered a substitution anchor for that detail. The contractor must submit a preliminary proposal for substitution as noted in the “SUBMITTALS” section of this specification. The structural capacity of the substitute anchor or anchor group must be no less than the capacity of the original anchors or the design load when shown on the plans.
- B. Other post-installed anchors will be considered in lieu of specified anchors provided they meet the requirements of both the “QUALITY ASSURANCE” section and the “SUBMITTALS” section of this specification. Submittals must be approved in writing by Engineer prior to installation.
- C. Cast-in anchorage in lieu of post-installed anchors will be considered provided that the anchors meet the requirements of the latest edition of ACI 318, Appendix D and calculations are prepared in conformance with the “SUBMITTALS” sections of this section.
- D. It is the contractor’s responsibility to obtain preliminary approval for substitutions from the A/E and Engineer in a timely fashion in conformance with the “SUBMITTALS” section of this specification.
- E. The contractor proposing substitutions shall be responsible for all additional costs incurred related to that substitution, including those of other trades and design professionals. The contractor proposing substitutions shall be responsible for coordination with all other trades.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Post installed anchors including adhesive, anchor and installation equipment must be furnished as a complete system.

2.2 MATERIALS

A. Fasteners and Anchors

1. Bolts and Studs: ASTM A307; ASTM A449 where “high strength” is indicated on the Drawings.
2. Carbon and Alloy Steel Nuts: ASTM A563.
3. Carbon Steel Washers: ASTM F436.
4. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
5. Wedge Anchors: ASTM A510; or ASTM A108.
6. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
7. Stainless Steel Nuts: ASTM F594
8. Zinc Plating: ASTM B633.
9. Hot-Dip Galvanizing: ASTM A153.
10. Reinforcing Dowels: ASTM A615.

- B. Interior Use (unless noted otherwise): Provide carbon steel anchors with zinc plating in accordance with ASTM B633 for use in conditioned environments free from potential moisture. For interior uses where anchor is in contact with preservative treated wood anchors must be mechanically galvanized, hot dip galvanized or 300 series stainless steel.

- C. Exposed Use: Provide stainless steel anchors using Series 300 stainless steel bolts with Series 304/316 or Type 18-8 stainless steel nuts and washers unless noted otherwise for the following conditions:

1. Exterior environments.
2. Potentially moist environments including exterior wall construction.
3. Corrosive environments including pools and pool equipment rooms.
4. All exterior wall cladding support and anchorage.
5. Where anchorage is in contact with preservative treated wood.
6. Any other location or detail that is noted on the plans.

2.3 PRODUCTS AND MANUFACTURERS FOR USE IN CRACKED CONCRETE

A. Expansion Anchors and Wedge Anchors:

1. HILTI KWIK BOLT-TZ2
2. HILTI HSL-3
3. HILTI KWIK BOLT 1

B. Screw Anchors:

1. HILTI KWIK HUS-EZ (KH-EZ)
2. HILTI KH-EZ I
3. HILTI KWIK HUS (KH) – (Uncracked Concrete Only)
4. Approved Equal

C. Undercut Anchors:

1. HILTI HDA
2. Approved Equal

- D. Adhesive Injection Systems for Anchoring Bolts or Reinforcing Steel into Concrete (Hammer drilled applications only, unless otherwise noted):

1. HILTI HIT-RE 500 V3 Adhesive
2. HILTI HIT-RE 500 V3 Adhesive (Diamond core applications)
3. HILTI HIT-HY 200 V3

4. Approved Equal

2.4 PRODUCTS AND MANUFACTURERS FOR USE IN GROUTED MASONRY

- A. Expansion Anchors and Wedge Anchors:
 1. HILTI KWIK BOLT-TZ2
 2. HILTI KWIK BOLT 1
 3. Approved Equal
- B. Screw Anchors:
 1. HILTI KWIK HUS-EZ (KH-EZ)
 2. HILTI KWIK HUS (KH)
 3. Approved Equal
- C. Adhesive Injection Systems for Anchoring bolts, including use with Screen Tubes:
 1. HILTI HIT-HY 270 Adhesive
 - a. Use composite mesh sleeves in hollow masonry and brick material
 2. HILTI HIT-ICE Adhesive
 3. Approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identify location of embedded items such as reinforcing steel, stressing tendons, conduit, heating tubes, etc. prior to drilling holes. Coordinate with respective trades if any apparent conflict exists. Exercise care in coring and drilling to avoid damaging any existing embedded items. If embedded items are encountered, stop drilling, and contact Engineer immediately. Any offsets or relocations of anchors must be approved by Engineer. This contractor is responsible for the cost of any required repairs including engineering costs.
- B. Install all post installed anchors in strict accordance with Manufacturer's Published Installation Instructions (MPII).
- C. Drill holes of proper diameter and depth in accordance with manufacturer's published design information for that specific anchor. Use only equipment approved by anchor manufacturer. All holes shall be perpendicular to the concrete surface unless shown otherwise on structural plans.
 1. Holes for adhesive anchors must be drilled using only hammer drills. Core drilling holes for adhesive anchors is prohibited.
 2. Do not drill holes until base material has cured for a minimum of 21 days.
- D. Clean out holes, properly prepare substrate, and install anchors in accordance with manufacturer's instructions. Proper tools must be on job site.
- E. Expansion Anchors, Wedge Anchors, Screw Anchors and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the engineer.
- F. For adhesive anchors, maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Verify that base material temperature is within manufacturer limits.

Do not install adhesive anchors if any criteria do not fall within manufacturer's limits. Ensure that bore holes and anchors are free of dust, standing water, ice, debris, grease, oil, dirt, and other foreign matter.

1. Dispose of initial mixture of hardener and resin pushed through the mixing nozzle. Mixture shall have a uniform color when installed.
 2. Do not reuse the mixing nozzle from a previous cartridge.
 3. Adhesive shall be injected from the bottom of the hole and the nozzle withdrawn as filling progresses. Spare adhesive must be visible all around the mouth of the hole following installation of the anchor.
- G. Protect anchors with approved fire-resistive materials, or spray-on fireproofing when anchors are attached to fire-resistive construction. Refer to ICC-ES Evaluation Service Reports (ESR's) Conditions of Use for applicability.

3.2 REPAIR OF DEFECTIVE WORK

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.3 FIELD QUALITY CONTROL

- A. Post-installed anchors for roof safety (OSHA) anchor systems shall be tested by a qualified testing agency hired by the contractor and satisfy the requirements on the drawings. Testing reports shall be provided showing compliance or rejection within 24 hours.
- B. Unless otherwise specified in the contract documents, all post-installed anchors shall be inspected and tested per the following schedule.
1. All down hole and non-adhesive inclined and horizontal anchors: 5% of each type of anchor.
 2. Inclined and horizontal adhesive anchors: 25% of each type of anchor.
 3. All anchor types supporting sustained loads and all overhead anchors: 100% of each type of anchor.
- C. Inspection: Inspect all anchor types to assure proper material are utilized as shown on the Contract Drawings or as approved via the shop drawing process. Post-installed anchor installation shall be completed per the MPII and the requirements of this specification.
1. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by the building official.
- D. Testing: Each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer.
1. Tension testing should be performed in accordance with ASTM E488.
 2. Torque shall be applied with a calibrated torque wrench.
 3. Proof loads for adhesive anchors shall be applied with a calibrated hydraulic ram. Proof load shall be 200% of the allowable service load or 80% of the rod steel yield strength – whichever is less.
 4. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.
 5. If any more than 10% of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.

3.4 CONTRACTOR'S RESPONSIBILITY

- A. Submit copies of all reports indicating conformance and exceptions to contract documents in a timely fashion to General Contractor for distribution to design consultants, owner, subcontractors, and other interested parties.
- B. Final Report: The Inspection Agency shall prepare a written report that summarizes the work inspected during the course of the project and certifies that the work meets the requirements of the contract documents, specifications, and all governing agencies.

END OF SECTION 050519

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SECTION 051210 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes structural steel and grout.

1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, “Code of Standard Practice for Steel Building and Bridges.”

1.3 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural steel fabricator to withstand LRFD loads indicated and comply with other information and restrictions indicated.
- B. Moment Connections: Where shown and as detailed in the contract documents.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural steel components
- C. Welding certificates
- D. Mill test reports
- E. Source quality control test reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator with 5 years minimum experience completing projects of similar scope.
- B. Welding: Quality procedures and personnel according to AWS D1.1, “Structural Welding Code Steel.”
- C. Comply with applicable provisions of AISC’s “Code of Standard Practice for Steel Buildings and Bridges.”

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL MATERIALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles, M, S-Shapes: ASTM A 36.
- C. Plate and Bar: ASTM A 36.
- D. Cold-Formed Hollow Structural Sections; ASTM A 500, Grade C, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High Strength Bolts, Nuts and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain
 - 2. Direct Tension Indicators: ASTM F 959, Type 325, compressible washer type with plain finish.
- B. Zinc-Coated High Strength bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563, Grade DH heavy hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct Tension Indicators: ASTM 959, Type 325, compressible washer type with mechanically deposited zinc coating or mechanically deposited zinc coating, baked epoxy coated finish.
- C. Tension-Control, High-Strength Bolt-Nut Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain or Mechanically deposited zinc coating.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1D1, Type B.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM G 1554, Grade 55, weldable.
 - 1. Finish: Plain
- F. Threaded Rods: ASTM A 36.
 - 1. Finish: Plain
- G. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.3 COATINGS

- A. Primer: Fabricator's standard lead and chromate-free, non-asphaltic, rust-inhibiting primer.
- B. Structural Steel Protective Coating: All structural steel exposed to the weather or embedded in exterior masonry walls shall be hot-dip galvanized in accordance with ASTM A123-84.

2.4 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."

- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.6 SHOP CONNECTORS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified
 - 1. Joint Type: Snug tightened; except use slip critical in connections subject to stress reversal conditions and in oversized or slotted holes.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearances, and quality welds and for methods used in correcting welding work.
 - 1. All shear connections shall develop the end reaction (Ultimate LRFD Load) $\phi_b W_c / 2L$, where " $\phi_b W_c$ " is the uniform load constant in kip-foot, and where "L" is the span in feet, as shown in the tables "Uniform Load Constants for Beams" (laterally supported) for given shape and steel specified, Manual of Steel Construction, 14th Edition, unless otherwise specified.
 - 2. The shear connection capacity for composite steel beams shall be determined by multiplying the beam reaction computed per the method described in Paragraph 2.2.C.4 above by 1.75 for all interior beams and 1.25 for exterior spandrel beams.
 - 3. All seated beam connections shall be designed so that the stiffener is clear of the finished ceiling and column encasement. The width of the stiffened seat shall not exceed 9". Beam web stiffeners shall be added as necessary to satisfy web yielding and web crippling code requirements.
 - 4. Moment connections shall develop the full capacity of beams unless a design moment capacity is specified in the contract documents.

2.7 SHOP COATINGS

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slab, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP2, "Hand Tool Cleaning"
 - 2. SSPC-SP3, "Power Tool Cleaning"
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- D. Galvanized: Immediately after surface preparation, apply the hot-dip galvanizing in accordance with ASTM A123-04 at the coating weight required by Table 1 to provide a uniform mil dry film thickness of 3.4 mils. Use galvanized methods which will result in full coverage of joints, corners, edges, and all exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Examination: Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Manual of Steel Construction, 14th Edition."
- C. Base and Bearing Plates: Clean concrete bearing surfaces of bond-reducing material and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage resistant grouts.
- D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless indicated otherwise.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Manual of Steel Construction, 14th Edition" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.4 TOUCH UP COATINGS

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide the minimum dry film thickness as previously specified.
- B. Steel which is abraded and rusty shall have primer and topcoat reapplied. Steel which is only abraded shall have topcoat reapplied.
- C. Immediately after erection, clean field welds, bolted connections and abraded areas of the hot-dip galvanized coating and coat all exposed areas per ASTM A780-80. Apply coating to provide dry film thickness of 3.4 mils as previously specified.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform shop and field inspections of welds and high strength bolted connections.
 - 1. Provide testing agency with access to places where structural steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded connections: Field welds will be visually inspected according to AWD D1.1.
 - 1. In addition to visual inspection, partial and full penetration welds shall be tested per the following inspection procedures:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 CONTRACTOR'S RESPONSIBILITY

- A. Acceptance of the shop and field inspection done by the testing agency pertaining to the structural steel, does not relieve the Contractor of his responsibility to ensure that the project has the proper sizes, strength, fabrication and erection procedures and any other requirements of the Contract Documents.
- B. Submit copies of all daily reports indicating conformance and exceptions to contract documents in a timely fashion to General Contractor for distribution to design consultants, owner, subcontractors, and other interested parties.
- C. Final Report: The inspection Agency shall prepare a written report that summarizes the work inspected during the course of the project and certifies that the work meets the requirements of the contract documents, specifications, and all governing agencies.

END OF SECTION 051210

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SECTION 061053 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking, cants, and nailers.
 - 2. Wood furring and grounds.
 - 3. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPAA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
- C. Certified Wood: Certify the following wood products as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004.
 - 1. Dimension lumber, except treated materials.
 - 2. Parallel-strand lumber.
 - 3. Rim boards.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Use treatment that does not promote corrosion of metal fasteners.
 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.

2. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
3. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Other Framing: No. 2 grade and any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cleveland Steel Specialty Co.
 - 2. KC Metals Products, Inc.
 - 3. Phoenix Metal Products, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. USP Structural Connectors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.

2.9 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally at 24 inches o.c.

3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetration firestopping systems for the following applications:
 - a. Penetrations in fire-resistance-rated walls.
 - b. Penetrations in horizontal assemblies.
 - c. Penetrations in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: At least two hours, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least two hours, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Contractor will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
 - 1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - d. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Field Test Report Log: For each elastomeric sealant application.

I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

J. Warranties: Special warranties specified in this Section.

K. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. VOC Content: Verify sealants and sealant primers comply with the following:
 - 1. Architectural sealants have a VOC content of [250] g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates have a VOC content of [250] g/L or less.
 - 3. Sealants and sealant primers for porous substrates have a VOC content of [775] g/L or less.
 - 4. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Multicomponent Nonsag Urethane Sealant:
 - 1. Products:
 - a. Pecora Corporation; Dynatrol II.
 - b. Tremco; Dymeric 511.
 - c. Tremco; Vulkem 922.

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use[s] Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
- B. Available Products:
 1. Sonneborn, Division of ChemRex Inc.; Sonolac.
 2. Tremco; Tremflex 834.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C closed-cell material with a surface skin and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Vertical joints on exposed surfaces of interior unit masonry, walls and partitions, structural steel.

1. Joint Sealant: Multi-component urethane, paintable sealant.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- B. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors and windows.
1. Joint Sealant: Latex sealant. Paintable.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

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SECTION 081100 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Division 8 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.

- C. Samples for Verification:
 - 1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- E. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Environmental Product Declaration: For each product.
 - 3. Health Product Declaration: For each product.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld International, LLC.
 - 2. Ceco Door Products; an Assa Abloy Group company.
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Greensteel Industries, Ltd.
 - 5. Pioneer Industries, Inc.
 - 6. Republic Doors and Frames.

7. Steelcraft; and Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches.
- c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.053 inch.
- d. Edge Construction: Model 2, Seamless.
- e. Core: Polyisocyanurate.

3. Frames:

- a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.053 inch.
- b. Construction: Full profile welded.

2.4 FRAME ANCHORS

A. Jamb Anchors:

- 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
- 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
- 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 08800 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 2. Fire Door Cores: As required to provide fire-protection ratings indicated.

3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 2. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 3. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 4. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

- A. Prime Finish for Interior Doors and Frames: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Exterior doors, frames and frame components are required to be cleaned, phosphatized, and finished with one coat of baked-on rust inhibiting prime paint in accordance with the ANSI/SDI A250.10 "Test Procedures and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.8 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Section 08800 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081100

SECTION 083113 - ACCESS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of access doors:
 - 1. Wall access doors.
 - 2. Fire-rated wall access doors.
 - 3.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 9 Section "Gypsum Board Assemblies" for gypsum board walls and ceilings.
 - 2. Division 23 Section "Heating, Ventilating, Air Conditioning and Plumbing" for access requirements to ductwork and plumbing piping concealed behind masonry construction or above gypsum ceilings.
 - 3. Division 26 Sections for access requirements for electrical components concealed behind masonry construction or above gypsum ceilings.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).
 - 1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.
- C. Shop drawings showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.
- D. Samples, 3-inch (75-mm) by 5-inch (125-mm) minimum size, of each panel face material showing factory-finished color and texture.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled

and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Method for Vertical Installations: ASTM E 152.
 2. Test Method for Horizontal Installations: ASTM E 119.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and coordinate with mechanical and electrical drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cesco Products.
 2. J.L. Industries.
 3. Larsen's Manufacturing Co.
 4. Milcor, Inc.
 5. Balco, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 366/A 366M commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.
- B. Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Electrolytic zinc-coated steel sheet with Class C coating and phosphate treatment to prepare surface for painting.

2.3 ACCESS DOORS

- A. Insulated, Fire-Rated Access Doors: Self-latching units consisting of frame, trim, door, insulation, and hardware, including automatic closer, interior latch release, and complying with the following requirements:
1. Frame with Exposed Trim: Perimeter frame with integral exposed trim complying with the following requirements:
 - a. Metal: 0.0598-inch- (1.52-mm-) thick steel sheet.
 - b. Trim: 1-inch (25.4-mm) flange overlapping surfaces surrounding door frame.
 2. Door: 0.0747-inch thick steel sheet, welded pan type.
 3. Hinges: Continuous concealed type.
 4. Fire-Protection Rating for Walls: 1-1/2 hours.
 5. Locks: Key-operated cylinder lock with interior release.

- B. Flush Access Doors with Exposed Trim: Units consisting of frame with exposed trim, door, hardware, and complying with the following requirements:
1. Frame: 0.059 inch (1.52 mm) thick steel sheet.
 2. Door: 0.747 inch (1.90 mm) thick steel sheet.
 3. Trim: Flange integral with frame, 3/4 inch (19 mm) wide, overlapping surrounding finished surface.
 4. Hinge: Continuous type.
 5. Locks: Key operated cylinder lock.
- C. Minimum size of any access door shall be 18"x24".
- D. Floor Access Panels.
- a. Provide ACT-10-250, 12" x 12" access cover with 1/8" tile recess by Balco, Inc. or approved equal.

2.4 FABRICATION

- A. General: Manufacture each access door assembly as an integral unit ready for installation.
- B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flange: Nominal 1 to 1-1/2 inches (25.4 to 38.1 mm) wide around perimeter of frame.
 2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.
 3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.
- C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.
1. For cylinder lock, furnish 2 keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions for installing access doors.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.
- C. Install concealed-frame access doors flush with adjacent finish surfaces.

3.3 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Electrified door hardware.
- B. Related Requirements:
 - 1. Section 081100 "Steel Doors and Frames".

1.3 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.

- c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.
 - C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Sample Warranty: For special warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
 - B. Schedules: Final door hardware and keying schedule.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 - B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - C. Deliver keys and permanent core to Owner by registered mail or overnight package service.
- 1.9 WARRANTY
- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection, cracking, or breakage.
- b. Faulty operation of doors and door hardware.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

- 2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 SCHEDULED DOOR HARDWARE

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
 - 1. Door hardware is scheduled on Drawings.

2.3 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - 1. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2.4 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

2.5 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION 087100

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SECTION 091110 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40.

- C. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 20 Gage minimum.
 - b. Depth: 3 5/8" Minimum, unless noted otherwise
 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 20 Gage minimum
 - b. Depth: 3 5/8" Minimum, unless noted otherwise
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; FlatSteel Deflection Track.
 - 3) Steel Network Inc. (The); VertiClip SLD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track.
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak System.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
 - d. Steel Network Inc. (The); VertiClip SLD Series.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.033 inch.
- G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

3. Provide where required for span.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.033 inch.
 2. Depth: 1-1/2 inches.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 3/4 inch.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where required, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 091110

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
- B. Related Requirements:
 - 1. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
- C. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and presconsumer recycled content and cost.
 - 2. Environmental Product Declaration (EPD): For each product.
 - 3. Product Data: For adhesives and sealants, indicating VOC content.
 - 4. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. Lafarge North America Inc.
 - 5. National Gypsum Company.
 - 6. USG Corporation.
 - 7. Clark Dietrich
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch minimum.
 - 2. Long Edges: Tapered.

- C. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
5. Long Edges: Tapered.
6. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

- D. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Provide Type X unless noted otherwise on the drawings.
2. Thickness: 5/8 inch, minimum unless noted otherwise
3. Long Edges: Tapered.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:

1. Interior Gypsum Board: Paper.

- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
2. Fill Coat: For second coat, use drying-type, all-purpose compound.
3. Finish Coat: For third coat, use drying-type, all-purpose compound.
4. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - d. USG Corporation; SHEETROCK Acoustical Sealant.
- E. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percents.
- F. Regional Materials: Manufacturer products within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
- G. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

- a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
- 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Type X: Where required for fire-resistance-rated assembly.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joint according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. U-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09912 "Interior Painting."

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ceilings composed of acoustical panels and exposed suspension systems.
- B. Non-Acoustical exposed beam suspended grid system.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Laboratory Test Reports: For ceiling products, indicating compliance with requirements for low-emitting materials.
- C. Product data for each type of product specified.
- D. Coordination drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension system members.
 - 2. Method of attaching suspension system hangers to building structure.
 - 3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 - 4. Minimum Drawing Scale: 1/8 inch = 1 foot.
- E. Samples for initial selection in the form of manufacturer's color charts consisting of actual acoustical panels or sections of panels and sections of suspension system members showing the full range of colors, textures, and patterns available for each ceiling assembly indicated.
- F. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - 1. 6-inch- square samples of each acoustical panel type, pattern, and color.
 - 2. Full-size samples of each acoustical panel type, pattern, and color. Set of 12-inch- long samples of exposed suspension system members, including moldings, for each color and system type required.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
 - 1. Obtain both acoustical panels and suspension system from the same manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Space Enclosure and Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition assemblies (if any).

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
 - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Verify ceiling products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring Noise Reduction Coefficient (NRC): Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches away from the test surface) per ASTM E 795.
 - 2. Test Method for Ceiling Attenuation Class (CAC): Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.
- B. Provide product as listed on the finish schedule on the drawings, and to match the existing materials..

2.3 GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes for all locker room areas.
- C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
 - 2. Stainless Steel Wire: ASTM A 580/ A 580 M, Type 304, Non-magnetic.
 - 3. Nickel-Copper Alloy Wire: ASTM B 164, nickel-copper alloy UNS N04400.
 - 4. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- E. Edge Moldings and Trim: Type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
 - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.4 NON-FIRE-RESISTANCE-RATED, DIRECT-HUNG SUSPENSION SYSTEMS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 - 1. Provide Donn DX grid 15/16" by USG. No substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
 - 1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.
- B. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and Cisca "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 - 2. Cisca Recommendations for Acoustical Ceilings: Comply with Cisca "Recommendations for Direct-Hung Acoustical Tile and Lay-In Panel Ceilings."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Splay hangers only where required, and if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices

that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.
 9. Use stainless steel wire hangers in shower rooms.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not over 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.18 mm in 3.66 m). Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 2. Paint the cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.
 3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- E. Product Schedule: For resilient base and accessory products.
- F. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For sealants, indicating VOC content.
 - 4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
 - 5. Laboratory Test Reports: For resilient base and stair products and accessories, indicating compliance with requirements for low-emitting materials.
 - 6. Environmental Product Declaration: For each product.
 - 7. Health Product Declaration: For each product.
 - 8. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Verify products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 VINYL BASE

- A. See finish schedule on drawings. Base shall match existing.

2.3 VINYL MOLDING ACCESSORY

- A. Description: Vinyl nosing for resilient flooring and transition strips.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Verify adhesives have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl composition floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples: Full-size units of each color and pattern of floor tile required.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile.
- F. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For chemical-bonding compounds, indicating VOC content.
 - 4. Laboratory Test Reports: For chemical-bonding compounds, indicating compliance with requirements for low-emitting materials.
 - 5. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.
 - 6. Environmental Product Declaration: For each product.
 - 8. Health Product Declaration: For each product.
 - 9. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
- B. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 FLOOR TILE

- A. Products: Subject to compliance with requirements, provide the resilient floor tile as scheduled on the drawings, and as a match to the existing VCT.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Verify adhesives have a VOC content 50 g/L or less.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacture.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than [9] [10] <Insert number> pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft.] <Insert rate> in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum [75] <Insert number> percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis and in tile patterns indicated on drawings.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern), unless required differently to match existing pattern.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply three coats.
- E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
- F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient floor tile surfaces before applying liquid cleaners, sealers, and finish products.
 - 1. Sealer: Apply two base coats of liquid sealer.
 - 2. Finish: Apply three coats of liquid floor finish.
- G. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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SECTION 096900 - ACCESS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cementitious-core steel panel access flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review connections between access flooring and mechanical and electrical systems.
2. Review requirements related to sealing the plenum.
3. Review procedures for keeping underfloor space clean.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Cementitious-core steel panel access flooring.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for access flooring.
2. Include loading capacities.
- 3.

C. Shop Drawings: For access flooring:

1. Include layout of access flooring and relationship to adjoining Work based on field-verified dimensions.
2. Details and sections with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, and understructures.

D. Samples: For the following products:

1. Floor Coverings: Full-size units for each color and texture specified.
2. Exposed Metal Accessories: Approximately 10 inches in length.
3. One full-size floor panel, pedestal, and understructure unit for each type of access flooring required.

E. Samples for Initial Selection: For each type of exposed finish.

F. Samples for Verification: For the following products:

1. Floor Coverings: Full-size units.
2. Exposed Metal Accessories: Approximately 10 inches in length.

- 3. One full-size floor panel, pedestal, and understructure unit for each type of access flooring required.
- G. Delegated Design Submittals: For seismic design of access flooring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:
 - 1. Coordinate mechanical and electrical work in underfloor cavity to prevent interference with access flooring.
 - 2. Mark pedestal locations on subfloor to enable mechanical and electrical work to proceed without interfering with access-flooring pedestals installed after mechanical and electrical work.
- B. Qualification Data: For Installer and testing agency.
- C. Product Certificates: For each type of access flooring.
- D. Product Test Reports: For each type of access-flooring material and floor covering, performed by a qualified testing agency.
- E. Seismic Design Calculations: For seismic design of access flooring, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panels: 8.
 - 2. Gratings: 1.
 - 3. Pedestals: 4.
 - 4. Stringers: 4.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field mockups.
 - 1. Use personnel, materials, and methods of construction that will be used at Project site.
 - 2. Notify Architect and Owner seven days in advance of the dates and times when laboratory mockups will be tested.
 - 3. Allow test installation to cure for manufacturer's recommended cure time, with a pressure of 25 lbf applied vertically to pedestals during this period.
 - 4. After curing, apply lateral load against a straight steel bar inserted 2 inches into pedestal stems. Measure the force needed to cause adhesive failure of pedestal base.
 - 5. Remove and discard failed pedestals, and clean pedestals of adhered residue.
 - 6. Proceed with installation only after tests show compliance with performance requirement specified for pedestals' capability to resist overturning moment.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install access flooring until spaces are enclosed, slab has been sealed, ambient temperature is between 50 and 90 deg F, and relative humidity is not less than 20 and not more than 70 percent.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Basis Of Design: The new access flooring shall match the existing flooring, which has been identified as manufactured by Tate Industries.
 - 1. Bolted Stringer system.
 - 2. Concore 1200 panels.
 - 3. Laminate panel finish – to match existing.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design access flooring for seismic performance, including loads imposed on the access flooring by items and equipment installed on the access flooring.
- C. Seismic Performance: Access flooring to withstand the effects of earthquake motions determined according to ASCE/SEI 7, including loads imposed on the access flooring by items and equipment installed on the access flooring.
- D. Structural Performance: Provide access flooring capable of complying with the "basis of design" performance requirements according to testing procedures in CISC's "Recommended Test Procedures for Access Floors":
 - 1. Utilize the weigh data as shown on the structural drawings and the electrical construction documents to perform the design calculations confirming that the product will support the loads and perform as required.
- E. Fire Performance:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

2.2 CEMENTITIOUS-CORE STEEL PANEL ACCESS FLOORING

- A. Cementitious-Core Steel Panel Access Flooring: Fabricate panels from cold-rolled steel sheet, with die-cut flat top sheet and die-formed and stiffened bottom pan welded together. Protect metal surfaces against corrosion using manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.
 - 1. Panels to match existing
 - 2. Configuration: Provide modular panels with nominal size of 24 by 24 inches, interchangeable with other field panels without disturbing adjacent panels or understructure.
 - 3. Attachment to Understructure: Bolted.
- B. Perforated Panels: Perforated top surface with holes of number, spacing, and size standard with manufacturer to produce a nominal open area of 25 percent. Provide mechanical dampers with each panel unit.

1. Quantity: As shown on Drawings.
 2. Finish: To match solid panels.
- C. Pedestal System Understructure: System consisting of base, column with provisions for height adjustment, and head (cap); made of steel.
1. Base: Square or circular base with not less than 16 sq. in. of bearing area.
 2. Column: Of height required to bring finished floor to elevations indicated. Weld column to base plate.
 3. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches and for locking at a selected height, so deliberate action is required to change height setting and prevent vibratory displacement.
 4. Head: Designed to support the floor panel indicated.
 - a. Bolted Assemblies: Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals.
- D. Stringer System Understructure: Modular steel stringer systems designed to bolt to pedestal heads and form a grid pattern. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.
- E. Floor Finish: Provide factory-applied floor finish fabricated in one piece to cover entire panel face; with integral trim edging.
1. High-Pressure Plastic Laminate: ISO 4586-5, Abrasion Class AC5.
 - a. Electrical Resistance: Average no less than 1 megohm and no more than 20,000 megohms when installed floor coverings are surface-to-ground tested according to NFPA 99.
 - b. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range to match the existing floor finish.

2.3 FABRICATION

- A. Fabrication Tolerances:
1. Size: Plus or minus 0.020 inch of required size.
 2. Squareness: Plus or minus 0.015 inch between diagonal measurements across top of panel.
 3. Flatness: Plus or minus 0.035 inch, measured on a diagonal on top of panel.
- B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.
- C. Bolted Panels: Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
1. Captive Fasteners: Provide fasteners held captive to panels.
- D. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.
1. Number, Size, Shape, and Location: As required by the contract documents.
 2. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.

2.4 ACCESSORIES

- A. Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.

- B. Post-Installed Anchors: For anchoring pedestal bases to subfloor, provide four post-installed expansion anchors made from carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5 (5 microns) for Class SC 1 (Mild), with the capability to sustain, without failure, a load equal to 1.5 times the loads imposed by pedestal-overturning moment on fasteners, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
- C. Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels; for power, communication, and signal services; and complying with the following requirements:
 - 1. Structural Performance: Cover capable of supporting a 50 lb. concentrated load.
 - 2. Cover and Box Type: Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles.
 - 3. Location: In center of panel quadrant unless otherwise indicated.
 - 4. Receptacles and Wiring:
 - a. Electrical receptacles and wiring for service outlets are specified elsewhere.
 - b. Equip each service outlet with power receptacles to comply with the following requirements:
 - 1) Type of Receptacle: Heavy-duty duplex, two-pole, three-wire grounding, 20 A, 125 V, NEMA WD 6, Configuration 5-20R unless otherwise indicated.
 - 2) Number of Receptacles for Outlet: Two.
 - 3) Factory Wired: For field hardwiring with armored cable, containing three insulated No. 12 AWG solid-copper conductors, terminated with a 6-inch- long pigtail.
 - 4) Power-in Connectors: Built into outlet housing, of type to fit power-in and power-out connectors of branch-circuit cables supplied with building electrical system.
- D. Floor Grilles: Standard load-bearing grilles formed from aluminum to produce removable one-piece unit precisely fitted in factory-prepared openings of standard field panels, with adjustable/removable dampers and complying with the following requirements:
 - 1. Air-Distribution Characteristics: 468 cfm at 0.10-inch wg static pressure.
 - 2. Structural Performance: Capable of supporting a 1000-lbf concentrated load.
 - 3. Fire-Test-Response Characteristics: Classified 94V-0 according to UL 94.
- E. Cavity Dividers: Provide manufacturer's standard metal dividers located where indicated to divide underfloor cavities.
- F. Fascia Closures: Where underfloor cavity is not enclosed by abutting walls or other construction, provide metal closure plates with manufacturer's standard finish.
- G. Panel Lifting Device: Panel manufacturer's standard portable lifting device for each type of panel required.
- H. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine substrates, with Installer and manufacturer's authorized representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of conditions and deleterious substances that might interfere with attachment of pedestals.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches.
- B. Locate each pedestal, complete any necessary subfloor preparation, and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.3 INSTALLATION

- A. Install access flooring and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.
- B. Adhesive Attachment of Pedestals: Set pedestals in adhesive, according to access-flooring manufacturer's written instructions, to provide full bearing of pedestal base on subfloor and as required to meet seismic design requirements.
- C. Mechanical Attachment of Pedestals: Attach pedestals to subfloor with post-installed mechanical anchors as required to meet seismic design requirements.
- D. Adjust pedestals so installed panels are flat, level, and at the proper height.
- E. Stringer Systems: Secure stringers to pedestal heads according to access-flooring manufacturer's written instructions.
- F. Install flooring panels securely in place, leaving them properly seated with panel edges flush. Do not force panels into place.
- G. Scribe perimeter panels to provide a close fit, with adjoining construction having no voids greater than 1/8 inch where panels abut vertical surfaces.
 1. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by panel manufacturer.
- H. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under installed access flooring.
- I. Grounded Access Flooring: Ground access flooring as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
 1. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.
- J. Underfloor Dividers: Scribe and install underfloor-cavity dividers to closely fit against subfloor surfaces, and seal with mastic.
- K. Closures: Scribe closures to closely fit against subfloor and adjacent finished-floor surfaces. Set in mastic and seal to maintain plenum effect within underfloor cavity.

- L. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.
- M. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
 - 1. Plus or minus 1/16 inch in any 10-foot distance.
 - 2. Plus or minus 1/8 inch from a level plane over entire access flooring area.

3.4 PROTECTION

- A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for **72** hours after installation, to allow pedestal adhesive to set.
- B. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION 096900

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. Gypsum board.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
- E. Sustainable Design Submittals:
1. Product Data: For paints and coatings, indicating VOC content.
 2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
 3. Environmental Product Declaration: For each product.
 4. Health Product Declaration: For each product.
 5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 6. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide product by the following:

1. PPG Architectural Finishes, Inc. or approved equal.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

- B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

- C. Colors: As selected by Architect from manufacturer's full range.

- D. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5) MPI #147.
- B. Galvanized-Metal Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer, galvanized, water based MPI #134.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
- C. Gypsum Board Substrates:
 - 1. Latex over Latex Sealer System:
 - a. Prime Coat: Latex, interior, matching topcoat.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.

END OF SECTION 099123

SECTION 104310 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of signs:

- 1. Acrylic wall signs / room signs.

1.3 SUBMITTALS

- A. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
 - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
 - 3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
- B. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Samples for initial selection of color, pattern, and texture:
 - a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
 - b. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.
 - 2. Samples for verification of color, pattern, and texture selected and compliance with requirements indicated:
 - a. Cast Acrylic Sheet and Plastic Laminate: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

1.4 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- C. Design Concept: The Specifications indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.
- D. Signs must meet all requirements of the Americans with Disabilities Act (ADA).

1.5 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manufacturers of Panel Signs:
 - a. ABC Architectural Signing System.
 - b. Allenite.
 - c. Andco Industries Corp.
 - d. APCO Graphics, Inc.
 - e. ASI Sign Systems, Inc.
 - f. Best Manufacturing Company.
 - g. Charleston Industries, Inc.
 - h. DGS Corp.
 - i. Diskey Sign Corp.
 - j. Environmental Graphic Systems, Inc.
 - k. Modulex.
 - l. Mohawk Sign Systems.
 - m. Poblocki & Sons, Inc.
 - n. Spanjer Brothers, Inc.
 - o. The Supersine Company.
 - p. Vomar Products, Inc.

2.2 MATERIALS

- A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
 - 1. Transparent Sheet: Provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested according to the requirements of ASTM D 1003 at signs to receive updateable paper

- inserts.
- 2. White Translucent Sheet: Where sheet material is indicated as "white," provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.
- 3. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.
- B. ABS Plastic: Provide high-impact thermoplastic composed of copolymers of acrylonitrile, butadiene, and styrene.
- C. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- D. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- E. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.
- F. Signs shall match the existing building standard.

2.3 PANEL SIGNS

- A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - 1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
- B. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
 - 1. Edge Condition: Beveled.
 - 2. Edge Color for Plastic Laminate: Edge color same as background.
 - 3. Corner Condition: Square corners.
- C. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit sign panel construction and mounting conditions indicated. Factory-paint brackets in a color matching the background color of the sign panel.
- D. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices. Text and room numbers will be furnished during construction.
- E. Raised Copy: Provide copy raise 1/32" minimum using one of these methods:
 - 1. Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.
 - 2. Photopolymer Panels: One piece .030" photopolymer sign face laminated to a .125" acrylic backplate.
 - 3. Panel Material: Matte-finished opaque acrylic sheet.
 - 4. Raised Copy Thickness: Not less than 1/32 inch.
- F. Panel Signs for Toilet Rooms: Provide wall mounted panel signs with the following:
 - 1. Pictogram on 7 1/2" w x 8" h module, raised 1/32".

2. Room name text and 3 digit room number, 5/8" h, raised 1/32", and Grade 2 braille on 7 1/2" w x 1 1/2" module.
3. The symbol of accessibility, raised 1/32" on a 7 1/2" x 4 1/2" h module.
4. Based on S-Series Standard System by ASI, or approved substitute.
5. Panel signs with room name and number: Provide 4 1/2" h x 7 1/2" w panel signs with the following:
 - a. Room number, 1" high text, raised 1/32", with Grade 2 braille.
 - b. Room name, 5/8" high text, raised 1/32".
 - c. Based on S. Series Standard by ASI or approved substitute.

2.4 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

2.5 ACCESSORIES

- A. Adhesive: As recommended by sign manufacturer.
 1. Verify adhesive have a VOC content of 70 g/L or less.
 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 LOCATIONS

- A. Provide signs for the following locations:
 1. The UPS Room in the existing corridor
 2. The Electric Room in the existing corridor.
- B. Coordinate the text and room number required for each sign with the County.
- c. Locate signs per ADA requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
 2. Where panel signs must be mounted on glass, mount blank covers of opaque sheet at the back side of the glass at the panel sign.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough (CMU) surfaces.
2. Shim Plate Mounting: Provide 1/8-inch-thick concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.
3. Mount a sign adjacent to all interior doors, new and existing. Mount according to ADA standards.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 104310

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SECTION 105220 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fire extinguishers.
 - 2. Fire rated extinguisher cabinets.
 - 3. Fire extinguisher mounting brackets.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.
- C. Samples for initial selection purposes in the form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.
- D. Samples for verification purposes in full-size units of each type of cabinet finish indicated, and in sets for each color, texture, and pattern specified, showing the full range of variations.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single manufacturer.
- B. Coordination: Verify that cabinets are sized to accommodate type and capacity of extinguishers indicated and provided by Owner under separate Contract.
- C. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ansul Fire Protection.
 - 2. American Specialties Inc.
 - 3. J.L. Industries.
 - 4. Larsen's Manufacturing Co.

2.2 FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard that comply with authorities having jurisdiction.
- B. Multipurpose Dry Chemical Type: UL-rated 4-A:80-B: C, 10-lb nominal capacity, in enameled steel container.
- C. Provide 3 extinguishers to be field located.

2.3 MOUNTING BRACKETS

- A. Brackets: Designed to prevent accidentally dislodging extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish.
 - 1. Provide brackets for extinguishers not located in cabinets.

2.4 CABINETS

- A. Construction: Manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
- B. Fire-Rated Cabinets: UL listed with UL listing mark with fire-resistance rating of wall where it is installed.
- C. Cabinet Type: Suitable for containing the following:
 - 1. Fire extinguisher.
- D. Cabinet Mounting: Suitable for the following mounting conditions:
 - 1. Surface Mounted: Cabinet box (tub) surface mounted on walls to suit style of trim indicated.
 - a. Manufacturer: Larson Cameo Series Aluminum C2409-SM or approved equal.
- E. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

- F. Trim Metal: Of same metal and finish as door.
- G. Door Material and Construction: Manufacturer's standard aluminum door construction, and vacuumed formed acrylic bubble, coordinated with cabinet types and trim styles selected.
- H. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to inside face of door bubble. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
 - 1. Application Process: Silk screen.
- I. Identify bracket-mounted extinguishers with FIRE EXTINGUISHER in red letter decals applied to wall surface. Use letter size, style, and location as selected by Architect.
- J. Door Style: Manufacturer's standard design.
 - 1. Solid Panel.
 - a. Silk-screen lettering or design.
- K. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.
- L. Provide 3 cabinets to be field located.

2.5 FINISHES FOR CABINETS, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying temporary strippable protective covering prior to shipping.
- C. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for thickness and framing for cabinets to verify mounting prior to cabinet installation.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Follow manufacturer's printed instructions for installation.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.

1. Provide fire treated blocking in the wall as required.

END OF SECTION 105220

SECTION 230100 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

- A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Mechanical Divisions.
- B. Contract drawings for mechanical work are diagrammatic, intended to convey scope and general arrangement. Contractor shall review and coordinate routing of new work to clear existing piping, duct, electrical, structure, etc. at no cost to the Owner. All dimensions of existing conditions shall be considered approximate (for information only). All dimensions shall be verified prior to construction.
- C. Contract Document Interpretation/Discrepancies:
 - 1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.
 - 2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.
 - 3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.
 - 4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Plumbing, Fire Protection, Information Technology (IT), etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.
- D. The complete set of Architectural, Structural, Civil, Mechanical, Electrical, Plumbing, Fire Protection and IT drawings, specifications, and addenda apply to this work.

1.2 SCOPE

- A. The work in Division-23 includes furnishing and installing the mechanical systems complete and ready for satisfactory service.
- B. Requirements specified govern work in all sections of Division-23.

1.3 REFERENCES

- A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
- B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.

1.4 DEFINITIONS

- A. Following are definitions of terms and expressions used in this Division:
 - 1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.
 - 2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
 - 3. "Directed" - directed by Engineer.
 - 4. "Ductwork" - includes ducts, fittings, housings, dampers, supports and accessories comprising a system.
 - 5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
 - 6. "Exposed" - not concealed.
 - 7. "Indicated" - indicated in Contract Documents.
 - 8. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.
 - 9. "Provide" - furnish and install.
 - 10. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.
 - 11. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements. Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.
 - 12. "Appurtenances" - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventers, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.
 - 13. "Record Documents" - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

- A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer's approval and without voiding warranties and/or certifications, have the equipment "broken down" into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.
- B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

- A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all mechanical, electrical and plumbing (MEP) system elements (including but not limited to: ductwork, HVAC piping, plumbing piping, insulation, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides, fire protection, etc.) coordinated with each other as well as the architectural and structural building elements. Installation drawings shall be based upon project specific, approved, product information for each of the MEP elements listed above (as well as architectural, structural, etc. systems), and shall be prepared at a minimum BIM LOD 400 (Building Information Modeling Level of Development 400) level of detail. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any mechanical equipment.
- B. Should the Contractor not provide the coordinated installation drawings required above, the following shall apply:
 - 1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.
 - 2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.
 - 3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.
- C. Electronic files (AutoCad or Revit) of mechanical, electrical and plumbing (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request). The electronic files shall not be utilized for the preparation of coordination/installation/fabrication shop drawings. Coordination/installation/fabrication shop drawings shall be created independently from the electronic MEP files (i.e. AutoCad drawings and/or Revit model). Please note: the electronic MEP Revit model (where applicable) was created at a level of detail similar to BIM LOD 300; however, some MEP elements were modified to provide clarity and legibility to the two-dimensional construction documents. In addition, the electronic files may include delegated design elements that may differ as a result of the final delegated design to be completed by the Contractor (this may include all disciplines including architectural, structural, etc.). Modifications of the MEP systems to accommodate those delegated design elements shall be provided by the Contractor at no additional cost to the Owner.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

- A. Use products of one manufacturer where two or more items of same kind of equipment are required.
- B. Materials and equipment shall have a record of two (2) years successful field use.
- C. Where a specific manufacturer is listed on the drawings, that manufacturer shall be considered the basis of design for that particular item of equipment. Only the basis of design manufacturer has been verified to meet the project requirements (i.e. dimensions, weights, service clearances, electrical requirements, etc.).
- D. Where the drawings and/or specifications indicate more than one manufacturer for a particular item of equipment, only those listed may submit products and services to be included in the work; manufacturers other than those listed will not be acceptable. Should the Contractor choose to use one of the specified manufacturers other than the basis of design, it shall be the responsibility of the Contractor to verify that the equipment meets all project requirements including, but not limited to, verification of all dimensions, weights, service clearances, electrical requirements, etc. All changes incurred shall be the responsibility of the Contractor and shall be provided at no additional cost to the Owner.
- E. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" paragraph of this specification section, as well as all other requirements indicated through the Division-23 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.
- F. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.8 MATERIAL AND EQUIPMENT LIST

- A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

- A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.
- B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.
- C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate

the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.

- D. **Manufacturer's Data:** Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.
- E. **Standards Compliance:** When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.
- F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including, a) the verification of equipment weights relative to the existing and/or new structural support system and b) the verification of equipment dimensions relative to existing and/or new architectural conditions. Contractor shall be responsible for correctness of all submittals.
- G. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The Contractor will be responsible to confirm that the final product and installation will be in conformance with the contract documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the Contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The Contractor must fulfill the terms of the contract.
- H. **Compliance Review Form:** Each equipment submittal must include a Compliance Review Form formatted as follows:
 - 1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
 - 2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual "C", "D", or "E" noted in the margin, as follows:

- a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.
- I. Electronic Submittals: Should the Contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:
 - 1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the Contractor’s review indicating compliance with the contract documents in accordance with paragraph 1.09.F of this section.
 - 2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
 - 3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
 - 4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
 - 5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
 - 6. Failure to comply with the above will result in the submittal being returned and marked “Not Reviewed”.
- J. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.
- K. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.
- L. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.
 - 1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor’s responsibility to submit the appropriate materials in a timely fashion.
 - 2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.
- M. Submittal Identifications:
 - 1. Place a permanent label or title block on each submittal for identification.
 - 2. Indicate name of firm or entity that prepared each submittal on label or title block.

3. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by A/E.
 4. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of A/E
 - d. Name and address of Contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate specification section
 - j. Drawing number and detail references, as appropriate
 - k. Other necessary identification
 - l. Example: 230700-01-0
 - 1) 230700 references the spec section
 - 2) 01 indicates this is the first submittal from this spec section
 - 3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)
- N. The Engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned "Not Acceptable" or "Revise and Resubmit", the Contractor shall choose one of the following courses of action:
1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design.
 2. Reimburse the Engineer for all additional review time required to achieve a submittal review from the Engineer of "No Exceptions Taken."
 3. Should the Contractor choose option 2 above, the Engineer shall be reimbursed at an hourly rate of \$175 per hour with payment due prior to the return of the final submittal. In addition, the Contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.
- O. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.
1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual "C", "D", or "E" as follows:

- a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
- b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
- c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

- A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

- A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

- A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.
- B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 SITE EXAMINATION/EXISTING CONDITIONS VERIFICATION

- A. Failure to visit site and become familiar with existing conditions prior to bidding will not relieve the Contractor of responsibility for complying with the Contract documents.
- B. Contractor shall field verify existing services and direction of flow of piping and ductwork prior to connection. Existing mechanical identification shall not constitute proper verification of service or direction of flow.

1.15 REGULATIONS AND PERMITS

- A. Comply with all applicable codes and regulations.

- B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.
- C. Obtain and pay for all required permits.

1.16 CUTTING AND PATCHING

- A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.
- B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.
- C. In precast concrete plank drill all holes with a Carbology tipped drill. Follow instructions of structural Engineer. Cut no reinforcing bars.

1.17 LINTELS

- A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical work. Lintels shall meet the requirements of the structural sections.

1.18 CLEANING UP

- A. Keep premises free from accumulation of debris.
- B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.
- C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.
- D. Leave all areas broom clean.
- E. Final clean-up shall be performed.

1.19 PROTECTION

- A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises.
- B. Cap or plug openings in equipment, piping, duct, and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.
- C. Unless approved by Owner, HVAC equipment shall not be used for temporary heating or ventilation during construction.
- D. Contractor shall protect all existing mechanical, electrical and architectural equipment, materials, finishes, etc. located within or adjacent to the work environment. Contractor shall be responsible for restoration of all existing mechanical, electrical and architectural items to remain. All equipment to remain must be restored to its pre-existing condition prior to the start of work. Restoration and/or replacement shall be at no cost to the Owner.

- E. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75°F (+2°F) and 50% RH (+5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the Owner accepts occupancy of the building.

1.20 CLEANING OF SYSTEMS

- A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.
- B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment to thoroughly clean the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.
- C. Leave strainers and dirt pockets in clean condition.
- D. Clean fans, ductwork, enclosures, flues, registers, grilles and diffusers at completion of work.
- E. Permanent air systems operated for temporary heating during construction shall only be operated with filters installed of equal efficiency to those specified. Prior to acceptance and after cleaning of system, replace with clean filters as specified. Return air openings shall be equipped with filter cloth to protect against debris entering the ductwork.
 - 1. If upon periodic inspection, it is determined that the permanent ductwork has become contaminated with construction debris, then the Contractor shall be required to procure the services of a professional duct cleaning agency prior to substantial completion, at no additional cost to the Owner.
- F. Should any system become clogged with construction refuse after acceptance, the Contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.
- G. Leave all systems clean, and in complete running order.
- H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.21 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

- B. Comply with all applicable specification sections including, but not be limited to, “Basic HVAC Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A “Functional Performance Test Verification Form” is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each air handling unit, fan coil unit, DX cooling equipment, etc.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

1.22 OPERATING AND MAINTENANCE MANUAL

- A. Submit Operation and Maintenance Manuals as follows:
 - 1. Provide an electronic version for review by the Owner and A/E, including bookmarks of all section and subsections.
 - 2. After acceptance of the electronic copy, produce hard copies in three-ring binders with each section separated by tab divider. Include protective plastic sleeves for any software or folded large documents submitted. Provide a minimum of two (2) copies to the Owner.
- B. At a minimum, the manual shall contain the following:
 - 1. Title page
 - 2. Table of contents
 - 3. Contractor and sub-contractor contact information
 - 4. Supplier contact information for all mechanical equipment
 - 5. Copies of manufacturer’s and Contractor’s warranty information (project and equipment) for all mechanical equipment.
 - 6. Submittal log for all mechanical equipment

7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and Owner submittal review comments.
8. Copy of inspector acceptance certificates / documents.
9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of the following:
 - a. System shutoff valves
 - b. Fire/smoke dampers
10. All duct, pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.
11. Final Test and Balance (TAB) Reports. Do not include reports that have not been accepted by the A/E. Pencil or partial copies will not be acceptable.
12. Maintenance procedures for each item of mechanical equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.
13. An itemized list of all spare parts and specialty tools shall be transmitted to the Owner.
14. A report of the training procedures and content provided as well as the attendance log.
15. Valve tag chart
16. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

1.23 TOOLS AND LUBRICANTS

- A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.
- D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.24 FIELD INSTRUCTION

- A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the mechanical and electrical systems.
- B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.

- C. Instructions shall be given by persons expert in the following systems and equipment and shall include descriptions and demonstration of procedures, data logging, and analysis.
 - 1. Air Systems - Including computer room air handling units, cooling coils, filters, fans, safety controls and other air handling equipment. Provide 8 hours of instruction.
 - 2. Automatic Control - Including operating controls for all heating, cooling, ventilating systems, control centers, panels, compressed air system. Provide 8 hours of instruction.
 - 3. General Instructions - Including review of written operating instructions and balancing report, miscellaneous instructions. Provide 8 hours of instruction.
- D. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than five (5) eight hour days.
- E. Prepare statement(s) for signing by Owner's representative indicating date of completion of instructions and hours expended. Furnish copy of signed statement to Engineer.
- F. Final mechanical demonstration of all mechanical equipment shall be recorded in DVD compatible format. Provide DVDs to the Owner.

1.25 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of mechanical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections.
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in the same electronic format as the construction documents (i.e. AutoCad or Revit). One (1) set of full size prints, one (1) CD of the electronic files, along with the red-lined marked up field set shall be delivered to the Owner upon completion. If requested, the electronic files shall be uploaded to the Owner's FTP site. The final documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the Owner's preferred version of AutoCad or Revit. Coordinate with the Owner before producing the CD or uploading to the FTP site. Not acceptable are Contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Electronic files (AutoCad or Revit) of mechanical, electrical, plumbing and fire protection (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request).

- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.26 DEMOLITION

- A. All demolition of existing mechanical and electrical piping, auxiliaries and equipment, shall be as specified under the Architectural "Demolition" section, of these specifications, as shown on the drawings, and as required to complete the new and renovated installations and shall be performed by the respective mechanical and electrical contractors.
- B. This work shall include the disconnection and capping of existing services, relocation of certain equipment, and the removal of existing piping, wiring, fittings, equipment, including heat transfer units, air handling units, fans, electrical controls and panelboxes, ductwork, etc., not reused in the new work or required to complete the renovation work. Contractor shall note the drawings specify certain existing equipment to be reused.
- C. Where supports and piping are removed, holes remaining in floors, walls and ceilings must be patched and refinished to match the adjoining original surfaces and finishes.
- D. Any removed items requested by the Owner shall remain the property of the Owner. Contractor shall remove equipment and store on site as directed by the Owner. All other equipment or material shall become the property of the Contractor and shall be removed from the site. Contractor shall meet Federal EPA Laws, Regulations and Guidelines in regard to removal of asbestos insulation.
- E. The Contractor shall use care when performing selective building and site demolition. The Contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the Contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The Contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.

1.27 OUTAGES

- A. All mechanical outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the Contractor and the Owner's Representative.
- B. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten (10) days in advance with the Owner's Representative. All such outages shall be performed during other than normal duty hours.
- C. The Contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and the convenience of the using agency.

1.28 GUARANTEE/WARRANTY

- A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.

- B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.
- C. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

PART 2 - PRODUCTS
Not Applicable

PART 3 - EXECUTION
Not Applicable

END OF SECTION 230100

SECTION 230200 - PROJECT CLOSEOUT HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This section provides a summary of the primary mechanical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:
 - 1. Pressure Testing
 - 2. Start-up
 - 3. Punch-out Procedures
 - 4. Testing, Adjusting and Balancing
 - 5. Functional Performance Testing and Verification
 - 6. Operation and Maintenance Manuals (O & M Manuals)
 - 7. Demonstration and Training
 - 8. Record Documents
 - 9. Close-out Documents
- B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 PRESSURE TESTING

- A. Piping: The Contractor shall perform pressure testing on all piping systems as indicated in Division-23 section "Testing, Adjusting and Balancing", and elsewhere as indicated.
- B. Ductwork: The Contractor shall perform pressure testing on all ductwork systems as indicated in Division-23 sections, "Testing, Adjusting and Balancing", "Low Pressure Ductwork" and "High Pressure Ductwork" and elsewhere as indicated.
- C. Air Handling Units: The Contractor shall perform factory and / or field pressure testing on all air handling units where required by the drawings or specifications.

- D. Final pressure test results shall be submitted as a separate project submittal for review and included with the Test and Balance Report. Upon review for general conformance, include all pressure tests in the O & M Manual.
- E. All factory performed equipment test results shall be included in the final O & M Manuals.
- F. Where re-tests were required, indicate remedial action taken and submit in test report.

3.2 START-UP

- A. The Contractor shall perform start-up on each piece of mechanical equipment as specified in each section of Division-23.
- B. Where indicated in each section of Division-23, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.
- C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

- A. Preliminary Punch-out:
 - 1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
 - 2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
 - 3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.
- B. Final Punch-out:
 - 1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
 - 2. A copy of the sign-off shall be provided to the Engineer for their record.
 - 3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
 - 4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:
 - a. Above ceiling
 - b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)

c. Equipment rooms

- C. Upon completion of any and all punch lists (i.e. above ceiling, final, partial, phased, factory review, or specific item) the contractor shall provide an item by item sign-off indicating the date and who completed the item. The sign-off shall be submitted to the A/E and owner before final payment is processed. Should the contractor disagree with any item, they shall provide a written exception giving reason for review.

3.4 TESTING, ADJUSTING AND BALANCING

- A. Comply with all provisions of Division-23 Section, "Testing, Adjusting and Balancing" (TAB) for the systems listed, but not limited to, the following:
1. Building Automated Systems
 2. Fans
 3. Air Handling Units
 4. Ductwork Systems
 5. Coils
 6. Piping Systems
 7. Terminal Units
- B. TAB reports shall be submitted as a separate project submittal for review. Upon review for general conformance, include the final TAB report in the O & M Manual.
- C. Comply with testing, adjusting and balancing requirements as indicated in each section within Division-23.

3.5 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.
- B. Comply with all applicable specification sections including, but not be limited to, "Basic HVAC Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A calibration verification report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

- F. A "Functional Performance Test Verification Form" is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each chiller, boiler, air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.6 OPERATION AND MAINTENANCE MANUALS

- A. Submit Operation and Maintenance Manuals as follows:
 - 1. Provide an electronic version for review by the Owner and A/E, including bookmarks of all section and subsections.
 - 2. After acceptance of the electronic copy, produce hard copies in three-ring binders with each section separated by tab divider. Include protective plastic sleeves for any software or folded large documents submitted. Provide a minimum of two (2) copies to the Owner.
- B. At a minimum, the manual shall contain the following:
 - 1. Title page
 - 2. Table of contents
 - 3. Contractor and sub-contractor contact information
 - 4. Supplier contact information for all mechanical equipment
 - 5. Copies of manufacturer's and contractor's warranty information (project and equipment) for all mechanical equipment.
 - 6. Submittal log for all mechanical equipment
 - 7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and owner submittal review comments.
 - 8. Copy of inspector acceptance certificates / documents.
 - 9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of the following:
 - a. System shutoff valves
 - b. Fire/smoke dampers
 - 10. All duct, pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.

11. Final Test and Balance (TAB) Reports. Do not include reports that have not been accepted by the A/E. Pencil or partial copies will not be acceptable.
12. Maintenance procedures for each item of mechanical equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.
13. An itemized list of all spare parts and specialty tools shall be transmitted to the Owner.
14. A report of the training procedures and content provided as well as the attendance log.
15. Valve tag chart
16. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

3.7 DEMONSTRATION AND TRAINING

- A. Upon completion of work, instruct the owner's representative in the proper operation and maintenance of each mechanical system in accordance with applicable specification sections.
- B. Instructions shall be given by persons expert in the operation and maintenance of each system / equipment.
- C. Prepare statement(s) for signing by Owner's representative indicating the date of completion of instructions and hours expended. Furnish copies of signed statements to the A/E.
- D. Final demonstration of all mechanical equipment shall be recorded in DVD compatible format.
 1. The recordings shall be organized systemically from largest to smallest component.
 2. The recordings shall include bookmarks to reference each type of equipment, all major components, and each component requiring regular maintenance.
 3. No segment shall be unannotated longer than fifteen minutes.
 4. Submit a digital link of the draft for review by the owner and A/E.
 5. Submit two hardcopy DVDs of the final approved copy to the owner's representative.
 6. Submit a digital link of the final approved copy to the owner's representative.

3.8 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of mechanical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents

will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Computer (CADD) files of mechanical drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.
- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

3.9 CLOSEOUT DOCUMENTS

- A. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:
 - 1. Final punch lists indicating completion of all items
 - 2. All record drawings
 - 3. All record specifications
 - 4. Operation and Maintenance Manuals
 - 5. Complete final cleaning
 - 6. Remove temporary facilities and complete site restoration

END OF SECTION 230200

SECTION 230500 - BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.
- B. Requirements specified in Division-23 Section "Basic HVAC Requirements" apply to this Section.

1.2 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
 - 1. Mechanical equipment nameplate data.
 - 2. Firestopping: Provide seals for all openings (new and existing) through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, ductwork, conduit, etc.
 - 3. Selective demolition including:
 - a. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
 - b. Dismantling mechanical materials and equipment made obsolete by these installations.
 - 4. Miscellaneous metals for support of mechanical materials and equipment.
 - 5. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
 - 6. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
 - 7. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

- A. The following definitions apply to firestopping:
 - 1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
 - 2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
 - 3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.

4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division-01 Specification Sections.
- B. Product data for the following products:
 1. Access panels and doors
 2. Joint sealers
- C. Firestopping: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.
 1. Provide details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.
 2. Provide drawings relating to non-standard applications as needed.
- D. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.
- E. Coordination drawings for access panel and door locations in accordance with Division-23 sections.
- F. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.
- G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.
- H. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division-01 Section "Summary of Work."

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.
 - 1. Provide UL Label on each fire-rated access door.
- D. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.7 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
 - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 - 2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

1.8 SEQUENCE AND SCHEDULING

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Architect at least five (5) days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

- A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

- A. All penetrations through fire barriers (new and existing) shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.
- B. Fire and /or combination fire smoke dampers shall be provided at all duct penetrations through fire/smoke rated partitions and damper shall be provided to match the assembly fire hour rating. Contractor shall refer to architectural plans for all wall assemblies and ratings.
- C. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, ducts, cable trays, conduit, and cables.
- D. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.
- E. Acceptable products shall be limited to Johns Manville "Firetemp-C1;" Hilti "FS-One;" or 3M "CP25WB+." Coordinate with General Contractor such that a single manufacturer/ product is utilized throughout the project for all fire and smoke stopping materials.

2.3 SMOKE STOPPING

- A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke (new and existing) shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.
- B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.02 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.

- E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

2.5 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.6 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
 - 1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
 - 2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
- D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
- E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.7 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.
 2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.
 3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
- C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.
1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
- D. Locking Devices: Flush, screwdriver-operated cam locks. [Common use]
- E. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys. [Secured areas only: note as such].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

- A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Seal new and existing holes or voids made by penetrations to ensure an effective smoke barrier.
- C. Where floor openings without penetrating items are more than four inches (100 mm) in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
- D. Protect materials from damage on surface subject to traffic.
- E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.
- F. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.
- G. Install smoke stopping as specified for firestopping (new and existing).
- H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch (300 mm) wide fiber dams for full thickness and height of air cavity at maximum 15 foot (4500 mm) intervals.

3.3 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- D. Mechanical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation.
 - 2. Piping and ducts embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings. Drain and cap piping and ducts that are allowed to remain.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.7 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - 2.
 - 3. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.
- B. Tooling: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.8 INSTALLATION OF ACCESS DOORS

- A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, dampers, air terminals, etc.
- B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 230500

SECTION 230513 - ELECTRICAL PROVISIONS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of electrical provisions to be provided as mechanical work is indicated in all other Division-23 sections, on drawings, and as further specified in this section.
- B. Types of work normally recognized as electrical, but provided as mechanical, specified or partially specified in this section, include but are not necessarily limited to the following:
 - 1. Motors for mechanical equipment.
 - 2. Motor starters and Variable Frequency Drives (VFDs) for mechanical equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical--electrical devices provided for mechanical systems, to equipment control panels.
 - 5. Electrical heating coils and similar elements in mechanical equipment.
- C. Refer to requirements of Division-26 sections.

1.2 QUALITY ASSURANCE

- A. Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division-26 sections for electrical work of this section which is not otherwise specified.
- B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.3 SUBMITTALS

- A. Listing, Motors of Mechanical Work: Concurrently, with submittal of mechanical products listing (Basic Mechanical and Division-1 requirements), submit separate listing showing rating, power characteristics, application (connected equipment), and general location of every motor to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.
 - 1. Include in listing of motors, notations of whether motor starter is furnished or installed integrally with motor or equipment containing motor.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Motor Characteristics: Except where more stringent requirements are indicated, and except where required item of mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:
- B. Temperature Rating: Rated for 113 degrees F (40 degrees C) environment with maximum 122 degrees F (50 degrees C) temperature rise for continuous duty at full-load (Class B Insulation).
- C. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than five (5) starts per hour for manually controlled motors.
- D. Phases and Current Characteristics: Provide squirrel cage induction polyphase motors for 1/2 hp (.4 kW) and larger, and provide capacitor-start single-phase motors for 1/3 hp (.25 kW) and smaller, except 1/6 hp (.1 kW) and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-23 requirements. For 2-speed motors provide two (2) separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- E. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
- F. Motor Construction: Provide general purpose, continuous duty motors, Class F insulation, Design "B" except "C" where required for high starting torque.
1. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division-23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
 2. Enclosure Type: Except as otherwise indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division-23 for other enclosure requirements.
 3. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
 4. Noise Rating: Provide industry standard "Quiet" rating on motors.
 5. Efficiency: For motors 1 horsepower (.7 kW) or higher, provide motors with minimum efficiencies as follows in accordance with IEEE Standard 112, Test Method B:
 - a. Open Motors (ODP)

MOTOR HP (KW)	MINIMUM EFFICIENCY *		
	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
1 (.7)	82.5%	85.5%	77.0%

1.5 (1.1)	86.5%	86.5%	84.0%
2 (1.5)	87.5%	86.5%	85.5%
3 (2.2)	88.5%	89.5%	85.5%
5 (4)	89.5%	89.5%	86.5%
7.5 (5.6)	90.2%	91.0%	88.5%
10 (8)	91.7%	91.7%	89.5%
15 (11)	91.7%	93.0%	90.2%
20 (15)	92.4%	93.0%	91.0%
25 (19)	93.0%	93.6%	91.7%
30 (22)	93.6%	94.1%	91.7%
40 (30)	94.1%	94.1%	92.4%
50 (38)	94.1%	94.5%	93.0%
60 (45)	94.5%	95.0%	93.6%
75 (56)	94.5%	95.0%	93.6%
100 (75)	95.0%	95.4%	93.6%
125 (94)	95.0%	95.4%	94.1%
150 (115)	95.4%	95.8%	94.1%
200 (150)	95.4%	95.8%	95.0%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

b. Enclosed Motors (TEFC)

MOTOR HP (KW)	MINIMUM EFFICIENCY *		
	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
1 (.7)	82.5%	85.5%	77.0%
1.5 (1.1)	87.5%	86.5%	84.0%
2 (1.5)	88.5%	86.5%	85.5%
3 (2.2)	89.5%	89.5%	86.5%
5 (4)	89.5%	89.5%	88.5%
7.5 (5.6)	91.0%	91.7%	89.5%
10 (8)	91.0%	91.7%	90.2%
15 (11)	91.7%	92.4%	91.0%
20 (15)	91.7%	93.0%	91.0%
25 (19)	93.0%	93.6%	91.7%
30 (22)	93.0%	93.6%	91.7%
40 (30)	94.1%	94.1%	92.4%
50 (38)	94.1%	94.5%	93.0%
60 (45)	94.5%	95.0%	93.6%
75 (56)	94.5%	95.4%	93.6%
100 (75)	95.0%	95.4%	94.1%
125 (94)	95.0%	95.4%	95.0%
150 (115)	95.8%	95.8%	95.0%
200 (150)	95.8%	96.2%	95.4%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

- c. Where fan or pump motors are used in conjunction with, or controlled by, a variable frequency drive (VFD), motors shall be suitable for VFD operation (inverter duty motors).
- d. For motors less than 1 horsepower (.7 kW), provide motors with higher efficiency than "average standard industry motors," in accordance with IEEE Standard 112, test method B.

- G. Nameplate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special feature and similar information.
- H. Motor Modifications: In cases where the equipment submitted requires additional motors and/or controls, circuiting and related equipment shall be provided as approved and in accordance with the National Electrical Code. All costs relative to these electrical changes shall be included under the Section in which the equipment is furnished and installed and shall be coordinated with the electrical work at no expense to the Owner.
- I. Power Factor: All motors one (1) horsepower and above shall have a minimum power factor of 0.90.
- J. All motors operated on variable frequency drives shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two (2) rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one (1) shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor pump manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.

2.2 MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES (VFDS)

- A. Where motor starters and/or variable frequency drives (VFDs) are indicated for mechanical equipment, they shall comply with all requirements outlined with the electrical specifications for motor starters and VFDs. Where motor starters and/or VFDs are provided by the mechanical contractor, or as a portion of a packaged mechanical unit, the electrical specifications shall also apply. All VFDs for the project, whether provided by the mechanical or electrical contractor, shall be provided by a single manufacturer, and shall include the same features and options.

2.3 MECHANICAL EQUIPMENT

- A. Electrical Heating Elements: Where electrical resistance coils and other heating elements are included in mechanical equipment or otherwise indicated as mechanical work, and except as otherwise indicated, provide 120-volt units where rating is less than 2 kW, higher-voltage single phase units where rating is 2 kW but less than 5 kW, and higher-voltage 3-phase units where rating is 5 kW and greater.
- B. All mechanical equipment shall be approved and listed by Underwriters' Laboratories (UL) and shall bear nameplate indicating same.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp (.25 kW) and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Deliver starters and wiring devices which have not been factory installed on equipment unit to electrical Installer for installation.

- C. Install furnished under Division-26 starter panels and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate in accordance with National Electric Code for installation requirements.

END OF SECTION 230513

SECTION 230514 - PIPE, TUBE AND FITTINGS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in all other Division-23 sections.
- B. Types of pipes and pipe fittings specified in this section include the following:
 - 1. Steel Pipes
 - 2. Copper Tube
 - 3. Miscellaneous Piping Materials/Products
- C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, ASME B31.3, ASME B31.9, and all other applicable ASME codes, for shop and project site welding of piping work.
 - a. Certify welding of piping work using the Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).
 - 2. Brazing: Certify brazing procedures, brazers and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of pipe and pipe fitting. In addition, submit a matrix indicating each service and the proposed pipe material and fitting.
- B. Welding Certifications: Submit reports as required for piping work.
- C. Brazing Certifications: Submit reports as required for piping work.
- D. Maintenance Data: Submit maintenance data and parts lists for each type or mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division-1.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage, and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service; where type, grade or class is not indicated. Provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 STEEL PIPES AND PIPE FITTINGS

- A. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.
- B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.
- C. Seamless Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.
- D. Galvanized Seamless Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.
- E. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- F. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- G. Stainless Steel Pipe: ASTM A 312; Grade TP 304.
- H. Steel Water Pipe: AWWA C200 for pipe 6" (150 mm) and larger.
- I. Coal Tar Protective Coatings and Linings for Steel Water Pipe: AWWA C203 for enamel and tape, hot applied.
- J. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.

- K. Cast-Iron Threaded Fittings: ANSI B16.4.
- L. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- M. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- N. Threaded Pipe Plugs: ANSI B16.14.
- O. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
 - 1. Material Group: Group 1.1.
 - 2. End Connections: Buttwelding.
 - 3. Facings: Raised-face.
- P. Steel Pipe Flanges for Waterworks Service: AWWA C207.
- Q. Corrosion-Resistant Cast Flanges/Fittings: MSS SP-51, including bolting and gasketing.
- R. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11 except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- S. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.
- T. Stainless Steel Buttwelding Fittings: MSS SP-43.
- U. Cast-Iron Threaded Drainage Fittings: ANSI B16.12.
- V. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.
- W. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2" (40 mm), and where pipe size is less than 1-1/2" (40 mm), and do not thread nipples full length (no close-nipples).

2.3 COPPER TUBE AND FITTINGS

- A. Copper Type: ASTM B 88; Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.
- B. DWV Copper Tube: ASTM B 306.
- C. ACR Copper Tube: ASTM B 280.
- D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
- E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

- F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
- G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
- H. Cast-Copper Flared Tube Fittings: ANSI B16.26.
- I. Bronze Pipe Flanges/Fittings: ANSI B16.24.
- J. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.
 - 1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
- B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.
 - 1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
 - 2. Silver Solder: ASTM B 32, Grade 96TS.
- C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.
 - 1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
- D. Gaskets for Flanged Joints: ANSI B16.21; full-faced or cast-iron raised face for steel flanges, unless otherwise indicated.
- E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" (1.6 mm) misalignment tolerance.
 - 1. Comply with ANSI B31 Code for Pressure Piping.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Where trapping is unavoidable, install drain valve with 3/4" (20 mm) hose end connection, cap and chain. Provide access panels as required. Orient horizontal runs parallel with walls

and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" (25 mm) clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

- C. Exposed piping in finished areas shall be covered with a 16 gauge steel primed and painted metal cover, secured to an adjacent structure and painted to match adjacent surfaces.
- D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

- A. General: Provide joints of type indicated in each piping system.
 - 1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
 - 2. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
 - 3. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- B. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
- C. Weld pipe joints in accordance with recognized industry practice and as follows:
 - 1. Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible.
 - 2. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
 - 3. Use pipe clamps or tack-weld joints with 1" (25 mm) long welds; 4 welds for pipe sizes to 10" (250 mm), 8 welds for pipe sizes 12" (300 mm) to 20" (500 mm).
 - 4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
 - 5. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
 - 6. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

- D. Weld pipe joints of steel water pipe in accordance with AWWA C206.
- E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.3 PIPING INSTALLATION

- A. All piping shall be installed level, plumb, and square relative to the adjacent building structure.
- B. Group piping, where practical, and install from common supports.

3.4 RADIOGRAPHIC (X-RAY) TESTING

- A. Field weld joints for all black steel pipe shall be radiographically (x-ray) tested to the extent identified below.
- B. Testing shall be conducted by an independent testing company. The testing company shall provide arrest report identifying the results of each weld tested (pass/fail).
- C. The Contractor shall engage the Owner and Engineer of Record to identify welds to be tested.
- D. Testing:
 - 1. If the total quantity of field welds is greater than 50, test 10% of field welds.
 - 2. If the total quantity of field welds is less than 50, test 25% of field welds.
 - 3. Should any of the initial welds tested fail, Contractor will be required to test an additional 20% of all remaining welds, at no additional cost to the Owner.
 - 4. Should any of the additional 20% of welds tested fail, Contractor will be requested to test 100% of all remaining welds, at no additional cost to the Owner.

3.5 CLEANING, FLUSHING, INSPECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
 - 1. Inspect pressure piping in accordance with procedures of ASME B31.
- B. Disinfect water mains and water service piping in accordance with AWWA C601.

3.6 PIPE TESTING

- A. Refer to Division-23 section "Testing, Adjusting and Balancing" for pipe testing requirements.

END OF SECTION 230514

SECTION 230515 - PIPING SPECIALTIES FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Types of piping specialties specified in this section include the following:
 - 1. Pipe Escutcheons
 - 2. Pipeline Strainers
 - 3. Dielectric Fittings
 - 4. Penetration Seals
 - 5. Drip Pans
 - 6. Pipe Sleeves
 - 7. Flexible Connectors
- C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-23 sections.
- D. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.
- B. Shop Drawings: Submit for fabricated specialties, indicating fabrication, materials, and method of support.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections.

2.2 PIPE ESCUTCHEONS

- A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 LOW PRESSURE Y-TYPE PIPELINE STRAINERS

- A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi (850 kPa) working pressure, with Type 304 stainless steel screens, with perforations as follows:
 - 1. Piping 2" (50 mm) and Smaller: 1/32" (.8 mm) diameter perforations.
 - 2. Piping 2-1/2" (65 mm) and Larger: 3/64" (1.2 mm) diameter perforations for water systems and 1/16" diameter perforations for steam systems.
- B. Threaded Ends, 2" (50 mm) and Smaller: Brass body, screwed screen retainer with centered blowdown fitted with valve and pipe plug.
- C. Threaded Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.
- D. Flanged Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.
- E. Butt Welded Ends, 2-1/2" (65 mm) and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.
- F. Grooved Ends, 2-1/2" (65 mm) and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

2.4 HIGH PRESSURE Y-TYPE PIPELINE STRAINERS

- A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 250 psi 1724 kPa) working pressure, with Type 304 stainless steel screens, with 3/64" (1.2 mm) perforations @ 233 per sq. in.
- B. Threaded Ends, 2" (50 mm) and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with valve and pipe plug.
- C. Threaded Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.
- D. Flanged Ends 2-1/2" (65 mm) and Larger: Cast-iron body, bolted steel retainer with off-center blowdown fitted with valve and pipe plug.
- E. Butt Welded Ends, 2-1/2" (65 mm) and Larger: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

2.5 DIELECTRIC FITTINGS

- A. General: Provide assembly or fitting having insulating material to isolate dissimilar metals to prevent galvanic action and stop corrosion.
 - 1. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035 kPa or 2070 kPa) minimum working pressure to suit system pressures.
 - 2. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070 kPa) working pressure at 225°F (107°C) temperature.
 - 3. Dielectric unions shall NOT be acceptable.

2.6 PENETRATION SEALS

- A. Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical piping. See Division-23 Section "Basic HVAC Materials and Methods" for penetration seals and firestopping requirements.
- B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as piping.

2.7 FABRICATED PIPING SPECIALTIES

- A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2" (65 mm). Reinforce top, either by structural angles or by rolling top over 1/4" (6 mm) steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" (25 mm) drain line connection.
- B. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" (75 mm) and smaller, 20 gage (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gage (1.6 mm); over 6" (150 mm), 14 gage (2 mm).
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.8 FLEXIBLE CONNECTORS

- A. Furnish and install braided stainless steel flexible connectors on the inlet and outlet of each pump, chiller, cooling tower, and all other piping connected to a vibrating piece of equipment. Construction shall be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid.

1. The corrugated metal hose, braids, and a stainless steel ring-ferrule/band (material gauge not less than .048") (material gauge not less than 1.2 mm) shall be integrally welded using a 100% circumferential, full-penetration TIG weld.
2. End fittings shall be flat-face plate steel flanges with 150#ANSI drilling and outside diameter. Fittings shall be attached using a 100% circumferential TIG/MIG weld.
3. Braided stainless steel connectors shall be suitable for operating temperatures up to 850°F (454°C).
4. The rated working pressure of braided metal hose shall have a minimum 4:1 safety factor based on an operating temperature of 70°F (20°C). Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.
5. Flanged connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start-up.
6. All braided stainless steel connectors shall be covered by a three (3) year warranty.
7. Minimum overall lengths shall be as follows:

Through 4" (100 mm) diameter:	9" (225 mm)
5" (125 mm), 6" (150 mm) diameter:	11" (275 mm)
Over 6" (150 mm) diameter:	1.5 times nominal diameter

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" (50 mm) and smaller installed ahead of control valves feeding individual

terminals. Where indicated, provide drain line from shutoff valve to drain, full size of blow down connection.

1. Locate Y-type strainers ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
 - a. Temperature control valves
 - b. Pressure reducing valves
 - c. Temperature or pressure regulating valves
- C. Dielectric Fittings: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

- A. Drip Pans: Locate drip pans under piping passing over or within 3' (0.9 m) horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" (25 mm) drain line to drain connection, and run to nearest drain as indicated.
- B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by the Owner. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two (2) pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Sleeves through floors shall be flush with the floor, except for sleeves passing through equipment rooms, toilet rooms (and other wet areas) which shall extend 3/4" (20 mm) above the floor. Space between the pipe and sleeve shall be caulked. Escutcheons plates shall be constructed to conceal the ends of sleeves. Extend floor sleeves 1/4" (6 mm) above level floor finish and 3/4" (20 mm) above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
 1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
 2. Install iron-pipe sleeves at exterior and interior foundation wall penetrations, both above and below grade. Penetrations shall be sealed weathertight.
 3. Install steel-pipe except as otherwise indicated.

3.3 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

- A. Provide flexible pipe connectors on the inlet and outlet of each pump, chiller, cooling tower and all other piping connected to a vibrating piece of equipment. Flexible connectors shall be full line size as indicated on the drawings and should be provided with control rods.

END OF SECTION 230515

SECTION 230523 - VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of valves required by this section is indicated on drawings and/or specified in other Division-23 sections.
- B. Types of valves specified in this section include the following:
 - 1. Drain Valves
 - 2. Ball Valves
 - 3. Check Valves
 - 4. Balancing Valves
- C. System Descriptions:
 - 1. HVAC Piping: HVAC piping shall relate to glycol water and heating water systems.
- D. Valves furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

- A. Valve Types: Provide valves of same type by same manufacturer.
- B. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating and size clearly marked on valve body.
- C. Codes and Standards:
 - 1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
 - 2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following, unless otherwise noted:
 - 1. Milwaukee
 - 2. Bray
 - 3. Apollo
 - 4. DeZurik
 - 5. Jamesbury
 - 6. Watts
- B. Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- C. Size: Unless otherwise indicated, provide valves of same size as upstream pipe size. Pipe size reduction shall be made after valve assembly.
- D. Valve Features: Provide the following as required:
 - 1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
 - 2. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.
 - 3. Drain: Comply with MSS SP-45 and provide threaded pipe plugs.
 - 4. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).
 - 5. Threaded: Valve ends complying with ANSI B2.1.
 - 6. Butt-Welding: Valve ends complying with ANSI B16.25.
 - 7. Socket-Welding: Valve ends complying with ANSI B16.11.
 - 8. Solder-Joint: Valve ends complying with ANSI B16.18.

9. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
10. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6" (150 mm) and smaller. Provide gear operators for quarter-turn valves 8" (200 mm) and larger. Provide chain-operated sheaves and chains for overhead valves 7'-0" A.F.F. or higher, unless indicated otherwise.

2.2 DRAIN VALVES

A. HVAC Piping:

1. 3" (75 mm) and Smaller: Class 125, bronze body ball valve with chrome plated ball, hose end with cap and chain. Milwaukee BA100H (Threaded), Milwaukee BA150H (Sweat) or equivalent.

2.3 BALL VALVES

A. Comply with the following standards:

1. Bronze Valves: MSS SP-110.
2. Potable Water: NSF-61-8.

B. HVAC Piping:

1. 2" (50 mm) and Smaller: Valves shall be rated 150 psi (1035 kPa) SWP and 600 psi (4140 kPa) non-shock WOG and shall have 2-piece cast ASTM B 584 bronze bodies, TFE seats, full port, separate packing nut with adjustable stem packing, anti-blowout stems and stainless steel ball. Valve ends shall have full depth ANSI threads or extended solder connections and be manufactured to comply with MSS-SP110. Milwaukee BA400S (Threaded), BA450S (Sweat) or equivalent with NSF compliance for potable water.

- C. Where piping is insulated, ball valves shall be equipped with 2" (50 mm) extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Memory stops, which are fully adjustable after insulation is applied, shall be included.

2.4 CHECK VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-71.
2. Bronze Valves: MSS SP-80.
3. Steel Valves: ANSI B16.34.

B. Glycol Piping:

1. 2" and Smaller: Class 150, bronze body, horizontal swing, T pattern with renewable TFE disc. Milwaukee 510T (Threaded), 1510T (Sweat) or equivalent.

2.5 BALANCE VALVES

- A. HVAC: See Division-23 section "Hydronic Specialties" for HVAC balance valve specification; however all valves shall meet the requirements of this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Except as otherwise indicated, comply with the following requirements.
 - 1. Install valves where required for proper operation of piping and equipment, including valves in branch lines, service mains and all equipment connections. Locate valves so as to be accessible and so that separate support can be provided when necessary.
 - 2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
- B. Insulation: Where insulated, install extended-stem valves, arranged in proper manner to receive insulation.
- C. Mechanical Actuators: Install mechanical actuators with chain operators for valves 7'-0" A.F.F. or above unless indicated otherwise. Extend chains to approximately five feet (1500 mm) above floor and secure to clips to clear aisle passage. Provide chain basket and 2" long PVC sleeve. Secure valve tag to sleeve.
- D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with connections to match pipe fittings.
- E. Renewable Seats: Install valves with renewable seats, where applicable.
- F. Fluid Control: Except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principle reason for valve, install ball, globe or butterfly valves, as indicated.
- G. Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

3.2 ADJUSTING AND CLEANING

- A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.
- B. Valve Identification: Tag each valve in accordance with Division-23 section "Identification for HVAC Piping and Equipment".
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division-23 sections.
- B. Types of hangers and supports specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports
 - 2. Vertical-Piping Clamps
 - 3. Hanger-Rod Attachments
 - 4. Building Attachments
 - 5. Saddles and Shields
 - 6. Spring Hangers and Supports
 - 7. Miscellaneous Materials
 - 8. Anchors
 - 9. Equipment Supports
- C. Hangers and supports furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of hangers, rollers and supports, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Codes and Standards:
 - 1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers, rollers and supports.
 - 2. NFPA, UL, and FM Compliance: Provide products which comply with NFPA 13 listed and labeled by UL and FM where used for fire protection piping systems.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers, rollers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers, rollers and supports, complying with MSS SP-69.

- c. Fabricate and install pipe hangers, rollers and supports, complying with MSS SP-89.
- d. Terminology used in this section is defined in MSS SP-90.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hangers, rollers and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, selected by Installer to suit horizontal-piping systems in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.2 VERTICAL-PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.3 HANGER-ROD ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic

action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.4 BUILDING ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, rollers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.5 SADDLES AND SHIELDS

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 SPRING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

2.7 MISCELLANEOUS MATERIALS

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2).
- D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which hangers, rollers and supports are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install attachments at required locations within concrete or steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi (17240 kPa) is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, rollers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers, rollers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Support fire-water piping independently of other piping.
- D. Prevent electrolysis in support of copper tubing by use of hangers, rollers and supports which are copper plated, or by other recognized industry methods.
- E. Provisions for Movement:
 - 1. Install hangers, rollers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- F. Load Distribution: Install hangers, rollers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers, rollers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- H. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on chilled water piping, install coated protective shields.
 - 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.
 - 4. For all insulated piping 2-1/2" (63 mm) and larger, provide insulated saddles as follows:
 - a. For glycol water and heating water provide the following:

- 1) Minimum 3.5 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
 - 2) For cold applications below 75°F (24°C) a zero permeability abuse resistant vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
 - 3) The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75°F (24°C) and comply with ASTM Standard C1126.
 - 4) Provide visible inspection sticker at the bottom of each saddle.
 - 5) Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.
- I. Spacing: Hanger spacing for piping shall not exceed 8 feet (2400 mm) on centers for pipe 1-1/4" (32 mm) or smaller, and 10 feet (3 m) for pipe 1-1/2" (40 mm) and larger. Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

3.4 ADJUSTMENT OF HANGERS AND SUPPORTS

- A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.5 EQUIPMENT SUPPORTS

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division-23. Size bases to extend minimum of 4" (100 mm) beyond equipment base in any direction; and 4" (100 mm) above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.6 PAINTING

- A. All hangers, supports, clamps and assemblies shall be primed and painted with rust inhibitors.

END OF SECTION 230529

SECTION 230548 - VIBRATION ISOLATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: The extent of vibration isolation work to be provided under this Contract is covered by the requirements of this Section, all other Division-23 sections and the Contract Drawings including structural, architectural, mechanical and electrical which identify equipment and systems requiring vibration isolation treatment.
- B. Types: Types of vibration isolation equipment and systems specified in this Section include:

<u>TYPE</u>	<u>DESCRIPTION</u>
1 Isolator	Ribbed Neoprene Pads
2I Isolator	Neoprene-In-Shear Type
2H Hanger	Rubber-In-Shear Type
3I Isolator	Open Spring Type
3H Hanger	Combination Spring and Neoprene Type
4 Isolator	Vertically Restrained Spring Isolators
5 Thrust	Restraints Spring Type Installed in Pairs
A Base	Directly Bolted Attachment
B Base	Structural Rails or Bases
C Base	Concrete Inertia Type

- C. Selection of Isolators: Provide isolators selected by a vibration isolator equipment specialist.
1. Conform to isolator types herein specified.
 2. Examine the contract drawings for sizes, horsepower, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment.
 3. Conform to the requirements of the most current edition of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, "HVAC Applications", Sound and Vibration Control.

1.2 QUALITY ASSURANCE

- A. Codes: At a minimum, conform to the most current edition of ASHRAE Handbook, "HVAC Applications".
- B. Manufacturer: Isolators of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

1.3 SUBMITTALS

- A. Contractor's Certification: Vibration isolator submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been

reviewed, and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation.

- B. **Manufacturer's Certification:** The manufacturer or manufacturers (if there are more than one) shall each certify that the selections of vibration isolation equipment are based upon the drawings and specifications, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that an appropriate isolator has been selected.
- C. **Product Data:** Furnish manufacturer's product data covering each isolator type for style, characteristic, and finish.
 - 1. Isolator quantities, dimensions, deflections, capacities and types shall remain the responsibility of the manufacturer and the Contractor.
- D. **Shop Drawings:** Where coordinated shop drawings are required, provide layout drawings, drawn to a scale of not less than 1/4-inch to 1-foot (6 mm to 300 mm), showing the proposed layout of equipment and piping systems and the location and type of each vibration isolation device.
 - 1. Carefully examine other sections requiring coordinated shop drawings and prepare isolation shop drawings to the same scale showing the location of each vibration isolation equipment base, pipe hanger, flexible connection, and isolator.

1.4 STORAGE AND PROTECTION

- A. **Storage:** Store vibration isolation equipment indoors in the manufacturer's original shipping containers. Preclude the entrance of construction dirt and debris.
 - 1. Vibration isolation equipment and bases, which show signs of rust, cement or concrete fouling, dirt and construction debris shall be disassembled and cleaned, approved or removed from the project site and replaced with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:
 - 1. Mason
 - 2. Vibration Eliminator Co.
 - 3. Kinetics Noise Control

2.2 EQUIPMENT

- A. **Dimensions:** The schedule shows dimensions for deflection and sizes all in inches.
- B. **Spans:** Where referenced, the schedule shows spans of the longest bay dimension for slabs or beams supported between columns. Dimensions are in feet.

- C. Selection: Exact mounting sizes, dimensions and quantity of isolators and static deflection required shall be determined by the isolator manufacturer based upon equipment that will be furnished and installed by the Contractor under this Contract.
 - 1. Vibration isolation specialist shall coordinate his work with that of other trades to verify that equipment speeds, in revolutions per minute (rpm), are based upon actual equipment installed at the project site.
 - 2. Verify that equipment rpm and spring deflection selected are arranged so that resonance is avoided.

2.3 ISOLATOR TYPES

- A. Type 1 Isolators: Provide pad type vibration isolators consisting of either two layers of 3/8-inch (10 mm) thick elastomer, molded to contain a pattern with non-slip characteristics in all directions, and bonded to 16 gauge (1.6 mm) galvanized steel separator plates, or 1-inch (25 mm) thick precompressed molded fiberglass isolation pads. Minimum overall thickness shall be 1-inch (25 mm). Deflection shall be limited to 0.25 inches (6 mm) or less. Loading shall not exceed 40 pounds per square inch (280 kPa).
- B. Type 2I Isolators: Provide double rubber-in-shear or elastomer-in-shear with molded-in steel reinforcement in the top and bottom portions.
 - 1. Deflections shall be limited to 0.5 inches (13 mm) or less.
 - 2. Steel bases shall be drilled with mounting holes and equipment mounting points shall be threaded male or female connections.
 - 3. Treat resilient material with antiozone and antioxidant additives.
- C. Type 2H Hangers: Provide rubber-in-compression suspension hangers, consisting of a formed steel frame and elastomer isolation element and provided with attachments for top and bottom suspension rods.
 - 1. Design for a minimum 200 percent overload without noticeable deformation or failure.
 - 2. Metal components shall be galvanized or factory painted.
- D. Type 3I Isolators: Provide adjustable, freestanding, open spring isolators with combination leveling and equipment fastening bases.
 - 1. Spring elements shall be contained in upper and lower housing assemblies and shall have a minimum Kx-Ky of 0.75.
 - 2. Design springs for a minimum travel of 50 percent beyond the rated load.
 - 3. When fully compressed and "bottomed-out", isolators shall be capable of supporting a 150 percent overload without deformation and spring failure.
 - 4. A minimum 1/4-inch (6 mm) thick non-skid isolation pad shall be bonded to the underside of the base plate.
 - 5. Size base plates to limit floor loading to 100 pounds per square inch (690 kPa).
 - 6. Drill base plates for bolting, as required.

7. Provide means for anchoring the top element of the isolator to rails and equipment.
- E. Type 3H Hangers: Provide combination spring and elastomer hangers consisting of a formed steel frame with coil spring and elastomer insert in compression.
1. Design hangers to be capable of supporting a 200 percent overload without noticeable deformation or failure.
 2. Design hangers to allow a 30 degree misalignment without binding or a reduction in hanger efficiency.
 3. Design hangers for connection to equipment and supporting rods.
- F. Type 4 Isolators: Provide vertically restrained, freestanding, laterally stable, open spring type isolators.
1. Design for deflection exceeding 1/2-inch (13 mm).
 2. Provide built-in bearing and leveling provisions.
 3. Provide a minimum 1/4-inch (6 mm) thick non-slip elastomer vibration absorbing pad bonded to the underside of the isolator base.
 4. Outside diameter of each spring shall be equal to or greater than 0.9 times the operating height of the spring under rated load.
 5. Provide vertical limit stops to prevent hyperextension due to wind loads or upward movement when the load is removed. Limit stops shall not bind or inhibit spring movement during normal operating ranges.
 6. For exterior applications, steel housings shall be hot dipped galvanized and springs shall be neoprene or powder coated.
- G. Type 5 Thrust Restraints: Provide spring isolators of an adjustable, freestanding type enclosed within tubular mountings and arranged to be installed in pairs across the discharge of fan flexible connectors.
1. Design restraints to resist the thrust caused by duct internal air pressure.
 2. Install restraints on duct systems with an internal static pressure exceeding 3 inches water gauge (750 Pa).
 3. Restraints shall have the same deflection as isolators installed under the fans.

2.4 BASE TYPES

- A. Type A Bases: No supplementary base is required. Vibration isolators, specified elsewhere, shall be attached directly to the supported equipment or structural system.
- B. Type B, Structural Rails or Bases: Provide bases designed and supplied by the isolation equipment manufacturer.
1. Construct bases of mill rolled structural sections of sufficient dimension to limit the midpoint deflection or unsupported spans to 1/1440th of the span between isolators.

2. Include equipment static loadings, power transmission, component misalignment and cantilever loadings when designing structural sections.
 3. When head room is limited, coordinate the design of structural rails and isolators to reduce mounting heights.
 4. Factory finish with two (2) coats of equipment enamel.
- C. Type C, Concrete Inertia Bases: Provide concrete inertia bases designed by the isolator manufacturer and arranged to be filled with concrete in the field.
1. Construct base of mill rolled structural steel sections, factory mitered and welded into a rigid frame and supporting No. 4 reinforcing bars welded to the structural frame 8 inches (200 mm) on centers both ways and located 2 inches (50 mm) from the bottom of the block.
 2. Arrange for outrigger isolation mountings, anchor bolts and equipment support.
 3. Field fill with 3,000 psi cured-strength concrete. Trowel to a smooth hard finish.
 4. Clean structural steel of excess concrete and field paint all steel elements with two coats equipment enamel.
 5. The configuration of inertia bases shall be rectangular to accommodate equipment supported unless otherwise indicated.
 6. Minimum thickness of inertia bases, in addition to providing suitable mass, shall be sufficient to provide stiffness to maintain equipment manufacturer's recommended alignment and duty efficiency of power transmission.
 7. Minimum thickness shall be sufficient to result in a base deflection at midpoint of unsupported span of not more than 1/1440th of the span between isolators.
 8. Minimum thickness shall be 8 percent of the longest base dimension unless otherwise specified or indicated.
 9. For centrifugal pumps, the bases shall be a minimum 6 inches (150 mm) thick.
 10. Where inertia bases are used to mount pumps, the bases shall be long enough to support piping elbows for all connections.

2.5 PIPING AND DUCTWORK

- A. General: All ductwork and piping in mechanical equipment rooms and within fifty feet (15 m) of the vibration source (i.e. mechanical equipment such as air handling units, chillers, pumps, cooling towers, air compressors, etc.) shall be isolated from the building structure with flexible vibration isolators. Air handling units with less than two inches (500 Pa) of external static pressure shall be excluded from this requirement.
1. Suspend ductwork on Type 3H hangers.
 2. Suspend piping on Type 3H hangers.
 3. Floor-mounted ductwork and piping shall be supported with Type 4 spring isolators with deflections the same as the equipment to which the piping is attached.

- B. Reciprocating Equipment: Provide spring type hangers with deflections equal to that of reciprocating equipment, with piping arranged with offset elbows to absorb vibration.
- C. Risers: Pipe and duct risers within 100 feet (30 m) of mechanical equipment rooms shall be resiliently anchored to the building structure with Type 1 vibration isolators, near the midpoint of the risers.
 - 1. Risers shall be isolated and supported at each second floor with pairs of Type 3H hangers, having deflections a minimum of five times the anticipated thermal movement at the support point.
 - 2. Risers shall be guided as required with four (4) sets of Type 2I vibration isolators.
 - 3. Provide flexible neoprene or canvas connectors as specified in sheet metal ductwork at the connection point to all air moving equipment.
 - 4. Support ductwork with an internal pressure exceeding 3 inches (750 Pa) water with Type 3H hangers on maximum 10 foot (3 m) centers with deflections equal to the equipment isolators.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Manufacturer: All vibration isolation equipment shall be installed in accordance with the manufacturer's recommendations.
- B. Manufacturer's Representative: The vibration isolation installation and deflection testing after equipment start-up shall be conducted by a representative of the manufacturer.

3.2 TESTS AND REPORTS

- A. Testing: Each vibration isolation device shall be deflection tested. Two (2) copies of a bound report shall be submitted prior to final acceptance. The certification shall include the following:
 - 1. Certify that equipment has been isolated in accordance with Contract Drawings, specifications and submittals.
 - 2. Certify that all minimum specified deflections have been equaled or exceeded.

3.3 ANCHORING

- A. Installation: Installation shall comply with manufacturer's published recommendations and shall be installed so that isolators are plumb and are operating at a manner for which they were designed.
 - 1. Unless otherwise specified, all equipment shall be securely bolted to isolators, steel bases or concrete inertia bases.
 - 2. Indoor vibration isolators need not be attached to the structure unless required by local codes.
 - 3. Isolators installed outdoors shall be attached to building structure.

3.4 CLEANING

- A. Debris: Remove all debris from under equipment, and thoroughly clean steel bases, inertia bases and check for free movement.
- B. Adjustment: Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the manufacturer as specified.

3.5 GENERAL

- A. All exterior structural steel and/or steel housings of exterior vibration isolation materials shall be hot dipped galvanized.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections.
- B. Types of identification devices specified in this section include the following:
 - 1. Pipe and Duct Markers
 - 2. Painted Identification Materials
 - 3. Valve Tags
 - 4. Valve Schedule Frames
 - 5. Engraved Plastic-Laminate Signs
 - 6. Plastic Equipment Markers
 - 7. Plasticized Tags
- C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 or Owner standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" (213 mm x 275 mm) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.
- C. Maintenance Data: Include product data and schedules in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers' products which may be incorporated in the work include the following:
 - 1. Brady
 - 2. Seton
 - 3. Bunting
 - 4. Brimar

2.2 MECHANICAL IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option but provide single selection for each product category.

2.3 PIPE AND DUCT MARKERS

- A. Snap-on Type: Provide pre-printed, semi-rigid, snap-on color coded identification sleeves complying with ANSI A13.1. This type shall be used for insulated pipe sizes 2" and smaller.
- B. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive, vinyl markers conforming to ANSI A13.1. This style marker shall be applied to all uninsulated piping; insulated piping 2-1/2" and larger, and all ductwork.
- C. Flow Direction: Provide flow directional arrows either as part of markers, or separately attached to pipes and ducts.

2.4 PAINTED IDENTIFICATION MATERIALS

- A. Piping and Equipment Systems: Continuous color coded painting of piping and equipment shall be provided in all mechanical rooms in compliance with ANSI A13.1.

2.5 VALVE TAGS

- A. Brass Valve Tags: Provide 19-gage (1.2 mm) polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" (6 mm) high letters and sequenced valve numbers 1/2" (13 mm) high, and with 5/32" (4 mm) hole for fastener.
 - 1. Provide 1-1/2" (40 mm) diameter tags, except as otherwise indicated.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.6 VALVE SCHEDULE FRAMES

- A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with lexan.
 - 1. Locate one schedule where directed. Provide second schedule to Owner framed in rigid plastic frame with rigid plastic glazing.

2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - 1. Thickness: 1/16" (1.6 mm) for units up to 20 sq. in. (12900 mm²) or 8" (200 mm) length; 1/8" for larger units.
- B. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- C. Duty: Accident-prevention tags with appropriate wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.8 PLASTIC EQUIPMENT MARKERS

- A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers.
- B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - 1. Name and schedule number
 - 2. Equipment service

2.9 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown on plans. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

- A. General: Identify air supply, return, exhaust, intake and relief ductwork with pressure sensitive markers and arrows, showing ductwork service and direction of flow.
- B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 25 foot (7500 mm) spacings.
- C. Access Doors: Provide duct markers on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 PIPING SYSTEM IDENTIFICATION

- A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) exterior non-concealed, locations, and concealed gas piping.
 - 1. Near each valve and control device.
 - 2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes and similar access points which permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced intermediately at maximum spacing of 25 feet (7500 mm) along each piping run.

3.4 VALVE IDENTIFICATION

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
 - 1. Tagging Schedule: Comply with requirements of "Valve Schedule" of this section.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

- A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - 1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - 2. Fans and blowers.

3. Packaged HVAC central-station and air handling units.

- B. Lettering Size: Minimum 1/4" (6 mm) lettering for name of unit where viewing distance is less than 2'- 0" (600 mm - 0 mm), 1/2" (13 mm) high for distances up to 6'- 0" (1800 mm - 0 mm), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
- C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.6 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 EXTRA STOCK

- A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of testing, adjusting, and balancing (TAB) work required by this section is indicated on drawings and schedules, and by requirements of this section, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems, and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow), adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports to achieve the capacities or setpoints indicated on the contract documents, and recommending modifications to work as required to achieve the capacities or setpoints indicated on the contract documents.
- B. Component types of testing, adjusting, and balancing specified in this section shall include, but not be limited to, the following as applied to mechanical equipment:
 - 1. Building automated systems
 - 2. Fans
 - 3. Air handling units
 - 4. Ductwork systems
 - 5. Coils
 - 6. Piping systems
 - 7. Terminal units
 - 8. Air devices
- C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Tester's Qualifications: A firm certified by Associated Air Balance Council (AABC) who is not Installer of system to be tested.
 - 1. AABC Compliance: Comply with the current AABC's Manual "AABC National Standards", as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.
 - 2. Industry Standards: Comply with AABC recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing, except as otherwise indicated.
 - 3. ASHRAE Standard 111: Comply with current edition of ASHRAE 111, "Measurement, Testing, Adjusting and Balancing of HVAC Systems".
 - 4. Independence: TAB contractor shall be independently owned and operated with no affiliation with the general contractor, mechanical contractor, sheet metal contractor, design engineer, etc.

5. Experience: Each technician shall demonstrate a minimum of three years of actual test and balance field experience.
- B. Pipe Testing Procedures: Contractor shall pressure test all piping systems in accordance with the following:
 1. ASME Code for Pressure Piping B31, most current edition.
 2. National Fire Protection Association (NFPA), all applicable sections, most current edition.

1.3 SUBMITTALS

- A. Qualification: TAB contractor qualifications shall be provided as a formal submittal for review to demonstrate conformance with all qualifications indicated throughout the contract documents.
- B. Submit certified test reports, signed by the AABC Test and Balance technician who performed the TAB work. In addition, the report shall be certified by an AABC certified Test and Balance Engineer (T.B.E.) who is familiar with the project.
 1. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.
- C. The Contractor shall maintain a copy of AABC standards on the site during all TAB work. Said document(s) shall be made available to Owner representatives for reference as to minimum requirements.
- D. Maintenance Data: Include in maintenance manuals, copies of certified test reports, identification of instruments.

1.4 JOB CONDITIONS

- A. Do not proceed with testing, adjusting, and balancing work until work has been completed, tested, operable, and all balancing devices indicated on the contract documents have been installed. Ensure that there is no residual work still to be completed on the equipment to be tested.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
 1. Factory fabricated plastic plugs shall be used to patch drilled holes in ductwork and housings.

2.2 TEST INSTRUMENTS

- A. Utilize test instruments and equipment for TAB work required, of type, precision, and capacity as recommended in the following TAB standards:

1. AABC's Manual "AABC National Standards".
 2. Wherever permanently installed measuring equipment is provided, such as air volume monitors, flow meters, temperature and pressure gages, etc., these shall be used in addition to TAB instrumentation. Any discrepancies in accuracy shall be brought to the attention of the Owner. Where permanently installed instrumentation meets accuracy requirements for TAB work, they may be used provided TAB Contractor can verify calibration of installed instruments.
- B. The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser air flow measurements.

PART 3 - EXECUTION

3.1 FIELD WORK

- A. Prior to the mechanical installation, the mechanical and TAB contractors shall review the design documents for "balanceability" to confirm that all devices required to properly balance each system are to be provided under this contract. Recommended modifications and/or additions shall be made directly to the engineer and a minimum of 30 days prior to the installation of mechanical equipment.
- B. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, operable and accessible. Do not proceed with TAB work until unsatisfactory conditions have been corrected.
- C. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable AABC standards. All systems and components shall be balanced within $\pm 5\%$ of design air and water flows.
- D. Test, adjust and balance system during summer season for cooling and during winter season for heating systems, including operation at outside conditions within 3°F (2°C) wet bulb temperature of maximum summer design condition, and within 10°F (6°C) dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.
- E. For fan systems, provide sheave replacements where required to achieve specified air flows.
- F. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

3.2 REPORTS

- A. Prepare report of test results, including instrumentation calibration reports, in format recommended by AABC standards. Provide a System Summary page(s) at the front of the report.
- B. An interim/preliminary handwritten report shall be submitted to the Engineer for review prior to the formal submission of the report.
- C. Test reports shall include, but not be limited to, the following information:
 1. Air Handling Equipment Test:

- a. Air handling equipment shall include, but not be limited to, all fans (supply, exhaust, return, relief, make-up, ventilation, etc.), air handling units, fan coil units, unit ventilators, VRF terminals, chilled beams. etc.).
 - b. Design Conditions: CFM, static pressure, motor h.p., outside air CFM (where applicable), fan and motor RPM and fan motor h.p. for each fan.
 - c. Installed Equipment: Manufacturer, size, arrangement, class, motor h.p., volts, phase, cycles, and full load amps.
 - d. Field Test Results: Fan CFM, fan RPM, fan motor voltage, fan motor operating amps, fan motor operating b.h.p., total static pressure for each fan. In addition, where applicable provide external static pressure, air pressure drop across each coil, filter bank, attenuator, etc. (ie. provide total static pressure profile of each system), as well as leaving air temperature, outside air conditions (dry bulb/wet bulb) at time of test, coil flow data (GPM), coil entering and leaving air temperatures, coil entering and leaving water temperatures, coil water pressure drop, VFD settings at final test conditions, and duct static pressure setpoint. Air temperature difference measurements will not be acceptable.
2. Air Distribution Test: Main and major branch ducts and individual supply, return and exhaust terminals (VAV terminals, terminal reheat units, diffusers, registers and grilles):
- a. Design Conditions: Ductwork: CFM, duct size. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.
 - b. Field Test Results: Ductwork: CFM, duct size, number of velocity readings, average velocity reading. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.
- D. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where necessary, modifications which exceed requirements of contract documents for mechanical work.
- E. Record outdoor air temperature (dry bulb and wet bulb) at the time of testing air handling units, chillers, cooling towers, boilers and any other equipment where performance is affected by outdoor air conditions.
- F. Report shall include results of piping and ductwork tests indicated in paragraphs 3.03 and 3.04 of this section.

3.3 TESTS - PIPING

- A. Prior to the balancing of systems by the AABC certified balancing contractor, the mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.
- 1. Hydrostatic Test:
 - a. Glycol Water Supply and Return Piping
 - b. Heating Water Supply and Return Piping
- B. Pressure tests shall also be performed prior to the installation of all insulation materials.

- C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
1. Required test period is four (4) hours.
 2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.
 3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds one percent (1.0%) of test pressure.
 4. Upon completion of roughing-in and before setting fixtures, the entire new domestic water system shall be tested. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.
 5. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.
- D. Refer to Division-23 section "Testing, Adjusting and Balancing" for additional specific test criteria and test form to be completed.
- E. Sanitary and Storm Water Piping Systems:
1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.
 2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.
- F. Drain test water from piping systems after testing and repair work has been completed.
- G. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- H. Contractor shall submit piping leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Piping test results shall be recorded on the "Piping Leakage Test Summary Form (Hydronic and Air)" and "Piping Leakage Test Summary Form (Plumbing)" located at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the piping test section (each piping test section shall be numbered and color coded).

3.4 TESTS - DUCTWORK

- A. Prior to the balancing of systems by the AABC certified balancing contractor, all high and low pressure systems shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1%. In addition, current SMACNA and AABC Standards shall apply, where applicable, to meet the maximum 1% leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:
 - 1. Ductwork systems less than 2.0 in. wg E.S.P (Duct Pressure Class 2): Test to 2 in.wg.
 - 2. Ductwork systems between 2.0 in. wg and 5.0 in. wg E.S.P. (Duct Pressure Class 6): Test to 6 in. wg.
 - 3. Ductwork systems greater than 5.0 in. wg E.S.P. (Duct Pressure Class 10): Test to 10 in. wg.
- B. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.
- C. The balance contractor shall witness and certify all duct pressure tests.
- D. Contractor shall submit duct leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Duct test results shall be recorded on the attached "Air Duct Leakage Test Summary Form" at the end of this section; no other forms will be accepted. In addition, the duct leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the duct test section (each duct test section shall be numbered and color coded).
- E. All duct leakage test results shall be included with the final TAB report and the O&M manual. The orifice tube calibration chart shall also be included with the final duct leakage test report information.

3.5 TESTS - EQUIPMENT

- A. The contractor shall verify calibration of all indicating, recording, controlling and controlled devices throughout the mechanical system. Verify the proper function of all installed equipment and devices and the interlocking of all new systems as required by the contract documents.
- B. A report including successful calibration and function performance verification of all items indicated above shall be included in the Operations and Maintenance Manual.

3.6 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.
- B. Comply with all applicable specification sections including, but not be limited to, "Basic HVAC Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.

- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A "Functional Performance Test Verification Form" is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each air handling unit, fan coil unit, etc.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.7 FINAL TESTS, INSPECTION AND ACCEPTANCE

- A. At time of final inspection, Contractor shall recheck, in presence of Owner's Representative, random selections of data (water and air quantities, air motion, and sound levels) recorded in Certified Report. In addition, all rooms within scope of project shall be rechecked.
 - 1. Points and areas for recheck shall be selected by Owner's Representative.
 - 2. Measurement and test procedures shall be same as approved for work forming basis of Certified Report.
 - 3. Selection for recheck (specific plus random), in general, will not exceed 25 percent of total number tabulated in report, except that special air systems may require a complete recheck for safety reasons.
- B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more, greater than that recorded in Certified Report listings, at 10 percent or more of the rechecked selections, report shall automatically be rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new Certified Reports submitted, and new inspection tests made, at no additional cost to the Owner.
- C. Marking of Settings: Settings of valves, splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time.

END OF SECTION 230593

AIR DUCT LEAKAGE TEST SUMMARY FORM

Project Name: _____ Project Number: _____ Page __ of __

DESIGN DATA						FIELD TEST DATA RECORD								
Duct Test Section (No./Color)	Air System	Total System CFM	Test Section CFM	Allowable Leakage %	Allowable Leakage CFM	Diameter		Pressure (in. w.g.)		Actual Leakage CFM	Actual Leakage %	Test Result Pass/Fail	Test Performed By (initials)	Test Witnessed By (initials)
						Orifice	Tube	Duct(1)	Across Orifice					
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
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				1.0%										
				1.0%										
				1.0%										

Testing Performed By: _____
 (Company/Individual Name)

Witnessed/Certified By: _____
 (Company/Individual Name)

(1) Duct test pressure shall be 6.0 in. w.g. for High/Medium Pressure ductwork, or 2.0 in. w.g. for Low Pressure ductwork.

PIPING LEAKAGE TEST SUMMARY FORM
(HYDRONIC AND AIR)

Project Name: _____ Project Number: _____ Page _____ of _____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

- (1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
- (2) 150% of operating pressure but not less than 100 psi (hydronic), 200 psi (air, gas and vacuum) and 400 psi (refrigerant).
- (3) Four (4) hours minimum.
- (4) Shall not exceed 0.0%.

PIPING LEAKAGE TEST SUMMARY FORM
(REFRIGERANT PRESSURE TEST)

Project Name: _____ Project Number: _____ Page _____ of _____

System/Unit Tested (1)	Test Location	Test Pressure (2)	Actual Test Pressure	Test Start			Test Completion			Pressure Drop (4)	Pass/Fail
				Time	Temperature	Pressure	Time	Temperature	Pressure		

Name of Testing Agency/Company: _____

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

- (1) Equipment designation.
- (2) Per manufacturer's recommendation.
- (3) Twenty-four hours minimum from start to completion.
- (4) Shall not exceed 0.0%.

PIPING LEAKAGE TEST SUMMARY FORM
(PLUMBING)

Project Name: _____ Project Number: _____ Page _____ of _____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (PSI/FT-HD) (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

- (1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
- (2) 150% of operating pressure but not less than 100 psi , 200 psi for air-gas-vacuum, 10 ft. static head pressure or to the maximum rating of the joint.
Include joint cut sheets showing their ratings.
- (3) Four (4) hours minimum.
- (4) Shall not exceed 0.0%.

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, by requirements of this section, and all other Division-23 sections.
- B. Types of mechanical insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Fiberglass
 - b. Flexible Elastomeric
 - 2. Ductwork System Insulation:
 - a. Fiberglass

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project. Provide installer's certification by the manufacturer's training program where applicable.
- C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories, and intended use for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:
 - 1. Owens Corning
 - 2. Johns Manville
 - 3. Certainteed
 - 4. Armacell
 - 5. Knauf
 - 6. Aeroflex

2.2 PIPE INSULATION MATERIALS

- A. Fiberglass Pipe Insulation: ASTM C 547, Type 1 (up to 850°F) (up to 454°C), maximum k-value of 0.23 BTU-in/hr-ft²-deg F at a mean temperature of 75°F.
- B. Jackets for Piping Insulation: Jacket assembly shall be ASTM C 1136, Type I with vapor retarder (0.02 perms). All service jackets shall have a polymer coated exterior facing, shall resist water staining and shall not support mold or mildew growth. All service jackets shall be Owens Corning ASJ Max with SSLII closure system, or equivalent.
 - 1. All fittings shall be provided with pre-molded insulation with equivalent thickness and composition of insulation applied to the adjoining piping. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
 - 2. Encase exterior piping insulation with 26 gauge embossed aluminum jacket with weather-proof construction.
- C. Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.
- D. Adhesives, Sealer, and Protective Finishes: As recommended by insulation manufacturer for applications indicated. Volatile Organic Compound (VOC) emissions for materials and products utilized in construction shall not exceed the environmental limits as established by UL Greenguard.

2.3 DUCTWORK INSULATION MATERIALS (INDOOR)

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C), minimum k-value of 0.27 BTU-in/hr-ft²-deg F at a mean temperature of 75°F (24°C).
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, maximum k-value of 0.27 BTU-in/hr-ft²-deg F or minimum "out of package" R-value of 6.7 at a mean temperature of 75°F. For ductwork in ceiling

space directly below roof, provide insulation with maximum k-value of 0.25 and minimum “out of package” R-value of 8.0 (1.5 LBS/FT³ density).

- C. Ductwork Insulation Accessories: Provide bands, wires, tape, anchors, corner angles, and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated. Volatile Organic Compound (VOC) emissions for materials and products utilized in construction shall not exceed the environmental limits as established by UL Greenguard.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Only install mechanical insulation on systems while not in operation.

3.2 HVAC PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures and air conditioning condensate piping in mechanical rooms and/or on roofs.
- B. Cold Piping (40 Degrees F to ambient) (4 Degrees C to ambient):
 - 1. Application Requirements: Insulate the following cold HVAC piping systems:
 - a. HVAC glycol water supply and return piping.
 - b. AC Condensate piping.
 - 2. Insulate each piping system specified above with the following type and thickness of insulation:
 - a. Flexible Elastomeric. 1" (25 mm) thick for pipe sizes up to and including 1" (25 mm), 1-1/2" (40 mm) thick for pipe sizes 1-1/4" (32 mm) and 1-1/2" (40 mm) and 2" (50 mm) thick for pipe sizes 2" (50 mm) and larger. Armacell Armaflex Black Lapseal or equivalent.
 - b. Fiberglass: 1-1/2" (40 mm) thick for pipe sizes up to and including 1-1/4" (32 mm), 2" (50 mm) thick for pipe sizes 1-1/2" (40 mm) and larger.
- C. Hot Piping (to 200 Degrees F) (to 93 Degrees C):
 - 1. Application Requirements: Insulate the following hot HVAC piping system (water piping up to 200°F) (water piping up to 93°F):
 - a. HVAC hot water supply and return piping.
 - 2. Insulate each piping system specified above with the following type and thickness of insulation:

- a. Fiberglass: 1-1/2" (40 mm) thick for pipe sizes up to and including 1-1/4" (32 mm), 2" (50 mm) thick for pipe sizes 1-1/2" (40 mm) and larger.
- b. Flexible Elastomeric: 1-1/2" (40 mm) thick for pipe sizes up to and including 1-1/4" (32 mm), 2" (50 mm) thick for pipe sizes 1-1/2" (40 mm) and larger.

3.3 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork located inside the building.
- B. Cold Ductwork:
 - 1. Application Requirements: Insulate the following cold ductwork:
 - a. Unconditioned outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
 - b. HVAC supply air ductwork from air handling unit/fan discharge to diffuser or register, including all duct accessories (sound attenuators, etc.).
 - c. HVAC conditioned outside air ductwork connected to DOAS (dedicated outside air) system from unit discharge to diffuser or register.
 - d. HVAC return ductwork located in ceiling directly adjacent to roof, including all duct accessories (sound attenuators, etc.).
 - e. HVAC exhaust ductwork located in ceiling directly adjacent to roof, connected to DOAS (dedicated outside air) system.
 - f. HVAC plenums and unit housings not preinsulated at factory or lined.
 - g. Insulate neck and bells of supply diffusers.
 - h. External portions of air terminal (VAV, TRU's) heating coils.
 - 2. Insulate each ductwork system specified above with the following type and thickness of insulation:
 - a. Flexible Fiberglass: 2" (50 mm) thick with R-value of 6.7 (provide 2" thick with minimum R-value of 8.0 for supply ductwork located in ceiling space directly below roof), application limited to concealed locations.
 - b. Rigid Fiberglass: 2" (50 mm) thick, application limited to ductwork exposed to view, including mechanical rooms.

3.4 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
 - 1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Staples shall not be used.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Provide factory molded insulation or pre-fabricated fittings for all valves, fittings, unions, etc. Valve handles must be extended by the mechanical contractor to accommodate the insulation without reducing the thickness or integrity of the valve insulation.
- G. All water test ports shall be accessible from the insulation. In addition, water flow measuring stations require access from insulation to verify sizes and model.
- H. Extend piping insulation without interruption through pipe hangers, walls, floors and similar piping penetrations, except where otherwise indicated.
- I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" (75 mm) wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" (75 mm) wide vapor barrier tape or band. If using pipe hangers, follow manufacturer's instructions for installation.
- J. All exposed pipe insulation, including fittings, above 8' - 0" (2400 mm - 0 mm) of finished floor shall have 8 oz. (227 g) fire retardant canvas cover neatly cut and parted seams shall be sealed.
- K. All exposed pipe insulation, including fittings, within 8' - 0" (2400 mm - 0 mm) of finished floor or within a stairwell, shall be provided with aluminum or PVC protective covers. All edges shall be hemmed and all seams shall be concealed.
- L. All exterior piping shall be provided with an embossed aluminum jacketing system, or approved equivalent jacketing system. The aluminum jacket shall be a minimum thickness of 0.16" (0.4 mm) with pre-formed elbows as well as stainless steel bands and accessories. The product and installation shall protect the insulation from UV exposure and water.
- M. For all insulated piping, provide insulated saddles as follows:
 - 1. For glycol and heating water provide the following:
 - a. Minimum 3.5 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
 - b. Armacell Armafix EcoLight non-compressive, rigid, support may be used for cold water piping with flexible elastomeric insulation, approved for use in air plenums per UL 2043 for a maximum ID of 1".
 - c. For cold applications below 75°F (24°C) a zero permeability abuse resistant vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
 - d. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75°F (24°C) and comply with ASTM Standard C1126.

- e. Provide visible inspection sticker at the bottom of each saddle.
- f. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.
- g. Armacell Insuguard Pipe Saddles may be used for cold water piping with flexible elastomeric insulation.

3.5 INSTALLATION OF DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
 - 1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.
 - 2. Install insulation materials with smooth and even surfaces.
 - 3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
 - 4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Seal all joints with vapor barrier material.
 - 5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- B. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound lining has been specified.
- C. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.
- D. All balancing damper handles shall be exposed and visible on externally insulated ductwork.

3.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division-23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

3.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

3.8 EXISTING INSULATION REPAIR/REPLACEMENT

- A. Repair damaged sections of existing mechanical insulation, either previously damaged or damaged during this construction period. Insulation shall be as specified herein.
- B. Provide new insulation on existing mechanical piping where existing insulation has been removed due to damage, repair or abatement of existing hazardous materials.

3.9 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 230700

SECTION 230900 - AUTOMATIC CONTROL SYSTEMS (ELECTRIC-ELECTRONIC)

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: The extent of automatic controls work is indicated on the drawings and schedules and by the requirements of this Section, and all other Division-23 sections. The work includes, but is not limited to the following:
1. The provision of a complete and operational control system, including all devices necessary to perform the functions herein described or indicated on the drawings.
 2. The provision of 120 and 208 volt line voltage and 5 and 24 volt low voltage wiring and conduit types shall be installed in accordance with Division-26 of these specifications.
 3. The ATC contractor shall furnish and install all electrical wiring and conduit from power source, including termination, to all required ATC related power connections including, but not limited to, DDC controllers (provide low voltage controllers for air terminal units including transformers and disconnect switches as required), sensors, valve and damper actuators (including smoke dampers), air flow monitors, ATC panels, etc. The ATC contractor shall obtain a separate electrical permit as required by the local authority. The ATC contractor shall be wholly responsible for all power requirements necessary for a complete installation from the power source to all ATC related connections. All electrical work shall be installed in accordance with Division-26 of these specifications.
 4. The ATC contractor shall interface with fire alarm devices as required to accomplish equipment shutdown, alarms, etc. indicated in sequences.
 5. The ATC contractor shall coordinate and verify that all controllers, devices, and accessories are provided as required to accomplish all control functions and sequences indicated in the contract documents. Where control related devices are not provided by an equipment manufacturer, it shall be the responsibility of the ATC contractor to provide the control devices required to accomplish the functions and sequences indicated.
 6. All drilling, cutting and patching associated with the installation of control systems.
- B. Types: Provide automatic control systems of the following types:
1. Direct Digital Control (DDC) with electric actuation of valve and damper actuators.
 2. The automatic temperature control system shall include remote interface and web access capability. All building management system control features including, but not limited to, points, alarms, scheduling, graphics, trending, etc. shall be available for control and monitoring through web access as well as remote interface (coordinate exact location with the using agency, where applicable).

1.2 QUALITY ASSURANCE

- A. Systems Engineering: The systems engineering phase shall include the selection and integration of components into a complete system which will meet the performance and prescriptive requirements of the Contract, together with drawings, specifications, descriptions of operation, diagrams and other materials listed under "Submittals" paragraph of this Section.

B. Testing and Adjusting During and After Installation:

1. The testing and adjusting includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated, adjusted, and retested after installation in accordance with the specified sequences of operation and other characteristics of the control system. A report on test results, including set points and operating ranges of all components shall be submitted.
2. The testing specified in this paragraph shall not replace the testing specified in "Commissioning Tests and Verification" article of this Section.

C. Commissioning Testing and Verifications: The final phase of the quality assurance program of the project is the commissioning testing and verifications. This phase is to assure that the project is fully completed and that the systems are performing in accordance to specifications from end to end of the control systems. Demonstrations of the automatic control systems to the commissioning team in accordance to the requirements specified in Part 3 of this Section are required. A report on test results, including set points and operating ranges of all components, shall be submitted.

D. Testing: The testing phase of quality assurance includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated and retested after installation to perform in accordance with the specified sequences of operation and other characteristics of the control system.

E. Reporting and Demonstration: This phase shall include the submission of a written report describing the "actions taken during the testing" phase, and including the set points and operating ranges of all equipment and a demonstration that the system performs in accordance with contract requirements.

F. Operating Instructions and Training: This phase of quality assurance includes the training of operating personnel utilizing written operating instructions prepared and approved under the "Submittals" paragraph of this Section, and the mounting of laminated control diagrams where directed.

G. Maintenance Manuals: This phase includes the submission of four hard bound copies of all manufacturers' cuts, maintenance and operating instructions, test reports and demonstration material, copies of control diagrams, and copies of the manufacturers' certifications.

1.3 SUBMITTALS

A. Shop Drawings: For each system to be controlled, prepare a drawing which includes a system flow diagram, control diagram, sequence of operation and schedule of components. Control diagrams shall be complete with end-to-end connections of piping and wiring from component terminal.

B. Manufacturer's Data: For each manufactured device or subsystem submit manufacturers' specifications and printed photograph of the proposed device or subsystem. Include engineering descriptions, principle of operation and application, and proposed model, style or size clearly indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The automatic temperature controls shall be furnished, installed, commissioned and warranted by one of the following acceptable providers:

1. Siemens

- B. No distributors, wholesalers or manufacturers' representatives other than those listed above will be acceptable. In addition, manufacturers not listed above will not be acceptable.

2.2 SYSTEMS INTEGRATION

- A. Control Loop Characteristics: Carefully evaluate the characteristics of each control loop, the time constants, equipment characteristics, control accuracy, and reliability and provide a system which will operate smoothly, without hunting, and within the accuracies specified.
- B. System Components: Select components including sensors, transmitters, controllers, control devices, actuators, and instrumentation considering such factors as hysteresis, relaxation time, span, limits, and response time.

2.3 CONTROLLERS

- A. General: Provide electric or electronic controllers for each local control loop.
1. Provide controllers with local adjustable setpoint, adjustable proportional band for analog controllers or adjustable differential for two position controllers.
 2. Provide adjustable secondary input authority for dual input controllers with remote setpoint adjustment.
 3. Provide integral or test connections for measuring input and output signal.
- B. Electric/Electronic System Characteristics: Provide a system of control which shall have all of the following system characteristics. Systems which do not conform to all of the following requirements will not be acceptable.
1. The system shall consist of multiple, field adjustable controllers. The controller, power supplies, input/output and other components specified, including metal cabinet will be referred to as a "Field Panel."
 2. The field panel shall be capable of performing its assigned local loop control and other functions as a standalone unit. It shall perform all specified local loop control functions without interaction to other field panels, except for shared functions such as central time programs, heating-cooling changeover, etc.
 3. The field panel shall utilize control algorithms that permit proportional, integral, and derivative control as required. Control algorithms shall permit one, two or three mode control as specified or indicated on the drawings.
 4. Each field panel shall be capable of handling multiple control loops, with one or more controllers.
 5. The system shall utilize industry standard sensors.
 6. The field panel shall provide both analog and binary output control. Analog outputs shall be compatible with industry standard transducers. Provide a modulating analog output control signal. Binary output control commands shall be implemented through interposing control relays.

7. Field panels shall be of modular construction. The system shall utilize interchangeable components. The modular construction of the system shall permit quick repair, ease of expansion, and the use of standard controls.
8. Each field panel with sensors and controlled devices shall be capable of automatic, unattended restart in the event of electrical power failure. In the event of electrical power failure all controlled devices shall move to their predetermined "normal" positions. By normal, it is meant that spring-close valves shall close, spring-open devices shall open, spring return devices will return and magnetically held devices will move to the position dictated by the force of gravity. Upon the restoration of electrical power, the field panel shall automatically restart and provide control to its connected systems after power failures of up to 72 hours.
9. The field panel operating system shall reside in nonvolatile memory.
10. Site specific application data, setpoints and operator entered data shall be stored in volatile memory.
11. Nonvolatile memory shall include PROM, EPROM, EAROM, ROM and RAM.
12. The preceding terms describe a class of solid state semi-conductor memories manufactured with LSI (large-scale-integration) techniques. These terms are expanded as follows:
 - a. PROM - Programmable Read Only Memory
 - b. EPROM - Erasable PROM
 - c. EAROM - Electrically Alterable ROM
 - d. ROM - Read Only Memory
 - e. RAM - Random Access Memory

C. Field Panels: Provide field panels as follows.

1. Each field panel shall consist of a controller, power supplies, input/output modules, and other components specified.
2. Provide field panels where indicated. Provide additional controllers, if required, to support the control loops specified, the sequence of operations, number of monitoring points or other criteria to permit the field panel capacity to meet the specified functional requirements of the project.
3. Each field panel shall be capable of operation as a completely independent unit.
4. Each field panel or controller shall include its own operator's keypad or other means of adjustment on site by the operator.
5. Each field panel shall receive signals from industry standard sensors and input devices. Each panel shall have the capability to monitor the following types of inputs:
 - a. Analog inputs: 4 to 20 mA and 0 to 10 V DC.
 - b. Binary inputs: Dry contact closure and pulse accumulator.
 - c. Provide transducers and/or signal conditioning to adapt other sensor types.

- d. Field panels that permit the direct connection of resistance type sensors will be acceptable if the system accuracy, data resolution, value accuracy and sensor interchangeability, comply with all other requirements of the specification.
 - 6. The field panel shall directly control actuators and control devices. Each field panel shall be able to provide the following control outputs:
 - a. Binary outputs: Contact closure
 - b. Analog outputs: 4 to 20 mA, 0 to 10 V DC and 0 to 135 OHM.
 - c. Systems that do not provide direct analog outputs will be acceptable providing that they generate the specified output signal through transducers.
 - 7. Each field panel shall perform control functions and other routines, specified under Sequences of Operation.
 - 8. Each field panel shall accept binary inputs, on-off, open-close, or other two state data. Provide isolation and protection against input voltage up to 180 VAC peak.
 - 9. Each field panel shall provide Binary Output by contact closures for momentary and maintained operation of field devices. Provide electromagnetic interference suppression on all output lines to limit transients to non-damaging levels. Provide isolation and protection against voltage up to 180 VAC peak. Provide contacts rated for 2 A at 24 VAC.
 - 10. Each field panel shall be enclosed in a metal cabinet. The cabinet shall be constructed of 16 US gauge sheet steel, Provide sufficient access for wire and conduit to enter the cabinet. The cabinet shall have a hinge door and a pin tumbler lock. All field panel locks for the project shall be keyed alike. The cabinet shall be shipped to the project for installation without electronics. The electronics shall be added at the time of wire termination and system commissioning. All control wiring and system communications shall be electrically terminated inside the field panel.
 - 11. Provide a 15A duplex receptacle inside or immediately adjacent to the field panel. The receptacle shall be energized when power is disconnected from the field panel.
 - 12. Ground the field panel and power supply with a minimum No. 12 THHN unbroken ground wire to the building earth ground system. There shall be a maximum of 5 ohms measured between the ground at the field panel and the building ground system.
 - 13. Provide a master electrical power disconnect switch inside the field panel to disconnect all external power to the cabinet for maintenance and repair. The disconnect switch shall not affect the duplex receptacle hereinbefore specified.
 - 14. Provide screw type terminal strips in the field panel for the termination of all field wiring. Lay out terminal strips in a neat and orderly fashion and label each termination. All wiring entering the panel shall be routed through the panel wireways in a neat and workmanlike manner, properly tied or laced and terminated.
 - 15. Provide conduit and wire to connect the field panel to the nearest adequate source of emergency electric power.
- D. Wire/Cable Labeling: Label wire and cable as follows.
- 1. Label each cable and each conductor within 6 inches (150 mm) of the termination point. Cable and wire identification shall match the wiring identification shown on the installation and record drawings.

2. Wire identification labels shall be securely affixed to the wire and shall be of the preprinted type providing a durable vinyl or plastic covering over the printed lettering.
 3. Wire identification through color coding, embossed label tape, paper tags attached with string and handwritten labeling will not be acceptable.
- E. Transient Protection: Provide transient protection as required by the manufacturer.
- F. System Accuracy: Provide system accuracy in accordance with the following.
1. Each local system shall maintain end-to-end accuracy for one year from sensor to controlled device for the applications specified.
 2. Space temperature with a range of 50°F to 85°F (10°C to 29°C) plus or minus 0.75°F (.4°C) for conditioned space; 30°F to 130°F (-1°C to 54°C) plus or minus 1.0°F (.6°C) for unconditioned space.
 3. Duct temperature with a range of 40°F to 140°F (4°C to 60°C) plus or minus 1.0°F (.6°C).
 4. Outside air (OA) temperature with a range of minus 30°F to plus 130°F (minus -1°C to plus 54°C) plus or minus 2.0°F; with a subrange of plus 30°F to plus 100°F (plus -1°C to plus 38°C) plus or minus 1.0°F (.6°C).
 5. Water temperature with a range of 33°F to 100°F (1°C to 38°C) plus or minus 0.75°F (.4°C); the range of 100°F to 250°F (38°C to 121°C) plus or minus 2.0°F (1.2°C); and water temperatures for the purpose of performing BTU calculations using differential temperatures to plus or minus 0.5°F (.3°C) using matched sensors.
 6. High temperature water with a range of 0°F to 500°F (-18°C to 260°C) plus or minus 3.0°F (1.6°C).
 7. Pressure with a range for the specific application plus or minus 2.0 percent of range.
 8. Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of BTU calculations to plus or minus 2.0 percent of range.
- G. Accuracy and Stability: Equipment shall be selected for the appropriate range of the application. Equipment selected with ranges in excess of the application will be replaced at the Contractor's expense.

2.4 SENSORS

- A. General: Provide analog sensors for temperature controllers. Provide sensors with an output signal that varies continuously with the sensed temperature, within a specified range, of the thermistor or resistance type.
- B. Manufacturer: Temperature sensors shall be made by one manufacturer.
- C. Space Sensors: Provide space or room sensors with base plates thru-bolted into masonry or wall studs, brushed cast aluminum or 16 gauge (1.6 mm) ground and polished Type 316 stainless steel covers.
- D. Insertion Type: Stem or extended surface sensitive type with screw mounting plate and galvanized sheet steel insulation mounting box.
- E. Immersion Type: Stem or tip sensitive type with threaded immersion well base.

- F. Sensing Elements: Hermetically seal, except for bimetal type for room thermostats. Stem, tip or extended element shall be Type 304 stainless steel or annealed copper.
- G. Casing: Casing shall be constructed of watertight, vibration-proof, heat resistant high strength phenolic or 316 stainless steel.
- H. Sensor Wells: Provide 304 stainless steel, bronze, copper or monel machined wells, compatible with the immersion medium, and heat sensitive transfer material or liquid between sensor and well surface.

2.5 ELECTRONIC ANALOG SENSORS

- A. Range: Sensors shall operate within the range of minus 30°F to plus 220°F (minus -34°C to plus 104°C) for heating, ventilating and air conditioning (HVAC) systems.
- B. High Temperature Sensors: For high temperature water applications provide sensors with a range of 0°F to 500°F (-18°C to 260°C).
- C. Accuracy: Provide electronic analog sensors with an accuracy of plus or minus 0.25°F (.14°C).
- D. Time Constant Response: Provide sensors with a time constant response to achieve 60 percent of a step temperature change in six (6) seconds in air or water flowing at 3 feet per second (.9 m/s).
- E. Interchangeability: Sensors of the same type shall be interchangeable without calibration.

2.6 PRESSURE SENSORS

- A. Overpressure Protection: Provide pressure sensors impervious to instantaneous pressure changes of 150 percent of working pressure but not less than plus or minus 50 psig (340 kPa).
- B. Adjustment: Provide sensors with external adjustable span, adjustable zero and pulsation suppression.
- C. Finished Spaces: Conceal pressure sensors in recessed stainless steel housing with removable perforated brushed stainless steel cover.
- D. Sensor Characteristics: Provide pressure sensors with the following characteristics:
 - 1. Ambient Temperature: 40°F to 140°F (4°C to 60°C).
 - 2. Isolation Valves: Provide pressure sensors with stainless steel needle isolation valves between each sensor and sensor pressure source. Provide differential pressure sensors with 3-valve manifold for isolation and nulling.
 - 3. Siphon: On steam systems provide pressure sensors with a pigtail siphon between the sensor isolation valve and sensor. Provide condensate wells and blowdown valves for differential pressure sensors.
 - 4. Provide switching type sensors with platinum alloy, silver alloy or gold plated wiping contacts rated for the application, voltage and power levels.
 - 5. Provide valved calibration taps adjacent to each pressure sensor for calibration.

2.7 STATIC PRESSURE ANALOG SENSORS

- A. Types: Provide diaphragm sensors with solid state pre-amplifier electronic systems.
- B. Characteristics: Provide analog sensors with the following characteristics:
 - 1. Sensor span shall be not less than 150 percent and not more than 300 percent of the working pressure.
 - 2. Accuracy shall be 0.5 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

2.8 DIFFERENTIAL PRESSURE ANALOG SENSORS

- A. Types: Provide differential pressure analog sensors of the solid state pre-amplifier types for electronic systems.
- B. Characteristics: Provide sensors with the following characteristics:
 - 1. Sensor span not less than 150 percent nor more than 300 percent of the working differential pressure.
 - 2. Accuracy of 0.5 percent of calibrated span, including combined effects of linearity, hysteresis and repeatability.
 - 3. Pressure sensor shall withstand overpressure of not less than 200 percent working pressure and full vacuum underpressure without damage, changes in sensor accuracy or deformation.

2.9 DEW POINT AND RELATIVE HUMIDITY SENSORS

- A. Dew Point Sensors: Provide analog salt-phase transition or dual cooled mirror type sensors with an accuracy of plus or minus 3°F (1.6°C) dew point over the range of 10°F to 100°F (-12°C to 38°C) dew point.
- B. Relative Humidity Sensors: Provide analog precision resistance or hydro-mechanical gauge type relative humidity sensors, with an accuracy of plus or minus 2 percent of relative humidity over a range of 10 to 90 percent relative humidity.
- C. Shields: Provide 316 stainless steel weatherhoods and shields to protect outdoor sensors from sunlight, snow, ice, wind and rain and provide fan powered aspirator complete with wiring if recommended by the manufacturer.
- D. Indoor Covers: Sensors located in public spaces shall have brushed 16 gauge (1.6 mm) 316 stainless steel covers or recessed aspirating boxes with Allen head screw mounting plate.

2.10 THERMOSTATS

- A. Types: Provide electronic thermostats which operate in an analog proportional or binary two-position mode as required by the sequence of operation.
- B. Mounting: Mount thermostats in non-public spaces except room thermostats.
- C. Electric Analog Thermostats: Provide electric analog thermostat with the following characteristics:

1. Sensor shall be of the bulb or capillary type which shall actuate a 135 ohm 3-wire potentiometer for 0-10 VDC, or 4-20 milliamp proportioning control action of balanced bridge motor actuators.
 2. Sensor shall have adjustable setpoint range of not less than 80°F (27°C) throughout the range of 0°F to plus 250°F (-18°C to plus 121°C).
 3. Adjustable proportional band ranges from 3°F to 25°F (-16°C to -4°C) and capillary length of not less than 5 feet (1500 mm) shall be provided.
- D. Electric Two Position Duct and Immersion Thermostats: Provide thermostats with bimetal or bulb and capillary type sensor actuating one or more switching contacts.
1. Contact shall be rated for the imposed load or shall be a pilot duty type and provided with a control relay.
 2. Thermostats shall have adjustable setpoint throughout the range 0°F to plus 250°F (-18°C to plus 124°C).
 3. Differential shall be adjustable from 3°F to 10°F (-16°C to -12°C) for each contact for refrigeration, boiler and industrial applications.
 4. Fixed differential thermostats with differentials of 3 may be provided for On-Off control of unit heaters, ventilating fans and similar applications.
 5. Provide capillary tubes in the 5 to 20 feet (1500 to 6000 mm) lengths to suit applications.
- E. Freeze Protection Thermostats: Electric freeze protection thermostats shall be provided with capillary elements, and special purpose insertion elements not less than 20 feet (6000 mm) in length for the face of coils up to 80 square feet (7.4 m²). Freeze protection thermostats shall have the following characteristics:
1. A freezing condition at any one foot length increment anywhere along the sensing element shall activate the thermostatic switch.
 2. Switch shall require manual reset.
- F. Weather Shields: Provide weather shields and outside air sensing elements with the following characteristics:
1. Mount elements and shields on the north face of the building or location out of direct sunlight.
 2. Construct shields of 16 gauge (1.6 mm) 316 stainless steel with flanges bolted to a backplate with not less than four 1/4-inch (6 mm) diameter stainless steel bolts. Mount backplate to the building structure with expansion bolts.
 3. Construct shields to inhibit solar effects. Construct shields in a rectangular box configuration with ventilating raintight louvers to preclude the entrance of snow, ice and rain. Design for crossflow and vertical air circulation.
 4. Mount shields accessible for maintenance.
 5. Seal wall penetration watertight.
 6. All space thermostats shall provide local adjustability and programmable at the BAS, including override of local adjustability of the BAS

2.11 PRESSURE CONTROLLERS

- A. Types: Provide electric electronic pressure controllers of the analog or two- position type as required by the sequence of operation.
- B. Analog Controllers: Provide controllers with proportional action plus integral and derivative control modes.
 - 1. Provide sensing elements of the differential type measuring controlled medium and standard reference pressures.
 - 2. Air static pressure controllers shall have slack diaphragms with standard ranges 0 to 6 inches water column (0 to 1500 Pa) and an adjustable proportional band range of 0.02 to 0.5 inches water column (5 to 125 Pa).
 - 3. Sensing elements for duct applications shall be damped to preclude pulsation.
 - 4. Water differential pressure controllers shall have a minimum range of 0 to 50 psig (0 to 345 kPa) or 0 to 250 psig (0 to 1725 kPa) as required by the application with adjustable proportional band of one to 25 psig (170 kPa). Sensing elements shall be diaphragm type with 3-valve manifold. Provide siphons and pressure snubbers.

2.12 ELECTRIC PRESSURE SWITCHES

- A. Type: Provide bourdon tube or diaphragm type electric pressure switches with tamperproof adjustable set point and differential settings. Design switches for 200 percent overpressure and full vacuum underpressure without damage or accuracy impairment.

2.13 DAMPERS

- A. Standards: Provide opposed blade and parallel blade factory fabricated dampers of extruded aluminum, galvanized steel or stainless steel with metallic anti-friction non-ferrous bearing in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards.
- B. Types: Use parallel blade dampers in mixing chambers and plenums. Use opposed blade dampers for volume control, face and bypass dampers, smoke dampers, fan discharge, and variable air volume control.
- C. Pressure Rating: For fan systems less than 10-inch water gauge (2490 Pa) static pressure, design and construct dampers to withstand a pressure of 150 pounds per square foot (7.1 kPa) without damage, leakage, flexure, or distortion.
- D. Leakage: Maximum air leakage rate for all dampers shall not exceed 10 cubic feet of air per minute per square foot (50 L/s/m²) at atmospheric pressure when closed against a 4-inch water gauge (1000 Pa) static pressure.
- E. Operators: Damper operators shall have sufficient power to open and close the dampers and limit the leakage to the specified rate. Power wiring shall be extended to operator by this contractor.
- F. Shafts and Bearings: Provide cadmium plated steel shafts in permanently lubricated bronze sleeve bearings or permanently lubricated ball bearings.
- G. Blade Sizes: Reinforced or ribbed blades shall not exceed 8 inches (200 mm) in width nor 48 inches (1200 mm) in length.

1. Flat or unreinforced blades will not be acceptable.
 2. Damper sections exceeding 4 feet (1200 mm) in width or 4 feet (1200 mm) in height shall be constructed with multiple frames and linkages.
- H. Frames: Construct frames of factory welded galvanized steel hot dipped after construction or bolted extruded aluminum frames.
1. Dampers larger than 8 square feet (.7 m²) in area shall have corner bracing gussets at each corner welded to the damper frame.
- I. Linkages: Provide linkages to uniformly transmit damper operating forces to each damper blade.
1. Construct linkages of galvanized or cadmium plated steel or stainless steel.
 2. Bearings and joints shall be ball and socket or sleeve bearings of brass, bronze or stainless steel, with plated bolts and locking nuts.
- J. Seals: Provide mechanically attached elastomer or neoprene blade tip seal along the full length of each blade edge and flexible stainless steel seals along damper blade ends where the blades abut the frame. Adhesives or staples will not be acceptable.
- K. Damper Mounting: Mount dampers to casings and ductwork in conformance with SMACNA standards. Provide welded or bolted galvanized steel structural supports for dampers larger than 20 square feet (1.9 m²). Through bolt damper frames to structural supports.

2.14 AUTOMATIC VALVES

- A. Standards: For glycol water and low temperature hot water provide valves conforming to ANSI B16.15, "Cast Bronze Threaded Fittings," Class 125 copper bearing steel, bronze, or ANSI B16.1, "Cast Iron Pipe Flanges and Flanged Fittings," Class 125 cast iron. For high temperature water, steam above 25 pounds per square inch (170 kPa) and water above 100 pounds per square inch (690 kPa) provide valves conforming to ANSI B16.5, "Pipe Flanges and Flanged Fittings," cast steel or stainless steel. Select valve pressure class minimum 150 percent of maximum working pressure.
- B. End Connections: Provide valves with end connections as follows:
1. For glycol water, chilled water, low temperature hot water and low pressure steam provide valves with flanged connections on sizes 2-1/2 inches (65 mm) and larger and threaded connections on valves 2 inches (50 mm) and smaller.
 2. For high temperature water provide valves with welded end connections.
- C. Small Water Valves (1" and Smaller): For valves controlling low pressure and low temperature chilled or hot water sizes one inch and smaller, bodies shall be bronze, cast iron or stainless steel with screwed, union or flare connections.
- D. Valve Trim: Provide valve trim as follows:
1. Stems shall be 316 stainless steel.
 2. Disk and stuffing boxes may be bronze or 316 stainless steel.
 3. For all valves 1-1/2-inch (40 mm) and larger, stems, disks, and seats shall be 316 stainless steel.

4. All non-metallic parts of hot water and steam valves shall be designed for minimum 250°F (121°C) or 100°F (38°C) above system design temperature.
 5. Leakage: Control valves shall provide tight shut off in the closed position at 150 percent of maximum working pressure.
- E. Valve Characteristics: Select valves to provide equal percentage control of water and linear control of steam. Modulating valves for steam shall have V-port skirts, tapered plugs for water.
1. Butterfly valves that do not have “equal flow characteristics” will not be acceptable for modulating control.
 2. For two-position, water application action, butterfly valves may be used, provided the differential pressure across the valve does not exceed 25 pounds per square inch (170 kPa).
- F. Sizing: Provide valves of sizes indicated, or as herein specified.
1. Size steam valves with a pressure drop not to exceed 50 percent of the total differential between supply and return main at full indicated flow.
 2. Size water valves with a maximum differential pressure not greater 10 feet (480 Pa) or 1/2 the loss through the controlled apparatus, whichever is greater.
- G. Actuators: Provide actuators, sized by the manufacturer, of sufficient size and power to operate the valve under all conditions and to close the valve tight against maximum differential pressure.
1. Provide pilots for sequence operations, and cases where valve spring ranges have been increased to close off against system pressure.
 2. Comply with requirements of "Actuators" paragraph of this Section.

2.15 ELECTRIC ACTUATORS

- A. General: Provide electric motor driven actuators (operators) arranged "Fail Safe" in the event of power failure. Unless indicated otherwise, the fail position of each valve shall be the “last position” or “current position” at the time of failure. Design operators to be quiet in operation and function within a range 85 to 100 percent input power potential.
- B. Electric Actuators: Provide hydraulic or gear type electric actuators.
1. When operated at rated voltage each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.
 2. Provide an end switch to limit travel and design the actuator to continuously stroke without damage.
 3. Operators shall function properly within a range of 85 to 120 percent of line voltage. For actuators with input power greater than 100 watts, gears shall be ground steel, oil immersed, shaft shall be hardened steel running in bronze, copper alloy or ball bearing and operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.
 4. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.
 5. Two position actuators shall be of the single direction, spring return or reversing type.

6. Proportioning operators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
7. Reversing and proportioning operators shall have limit switches to limit travel in either direction.
8. For actuators with greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
9. All valve and damper actuators shall be 24 volt. Use of 120 volt actuators will be considered for selective applications such as: large valves (approximately 8-inch and larger), or line voltage control for unit heaters, cabinet heaters, etc. where acceptable to the using agency. In all cases (24 volt and 120 volt), power for valve and damper actuators shall be provided by the ATC contractor.

C. Damper Operator Mounting: Mount damper operators where accessible for maintenance.

1. If located outside the duct or casing, mount operators on a 14 gauge (2.0 mm) reinforced support plate arranged to allow insulation between the support plate and the face of the duct or casing.
2. Brace damper operators rigid to show no deflection or movement over the full range of the damper stroke.

2.16 CONTROL PANELS AND CABINETS

- A. Local Panels and Cabinets: Provide local control cabinets for each air handling unit, automatically controlled equipment such as pumps, fans, heaters and convertors, or groups of such equipment in a single mechanical equipment room.
- B. Standards: Construct panels in conformance with UL 50, "Cabinets and Boxes," or similar approved construction, with backbox, full-sized piano hinged face, stainless steel lockable latch, and secure to the building construction.
 1. Internally mount all controllers, relays, terminal boards, and miscellaneous control devices, on a removable panel.
 2. Flush mount in the door all indicators, selector switches, remote setpoint adjusters, and pilot lights.
 3. Cabinet internals may be factory or field wired and piped. Wire shall be neat, braced, and strapped flat to present a neat appearance and to easily trace wiring and piping from one device to another.
 4. Floor mounted panels shall be bolted to 1-1/2-inch by 1-1/2-inch (40 mm by 40 mm) structural support channel, bolted to the floor and braced at the top.

2.17 SYSTEM DIAGRAMS

- A. Mounting: Mount control diagrams adjacent to each local control panel on a furniture steel extension either bolted to wall or to an extension of the control cabinet structural support.
 1. Control diagrams shall include system one-line diagram, system control diagram, sequence of operations, and schedule of control devices.
 2. Diagrams shall be hermetically sealed in laminated 16 gauge (1.6 mm) plastic.

3. Diagrams shall be permanent, black on white background, not subject to fading when subjected to artificial or natural light. Diazo prints are not acceptable.
4. Diagrams shall represent the current, "as-built" status of the control system, after acceptance by the representative of the Owner.
5. Obsolete, out of date, or field modified diagrams shall be removed, and new current diagrams furnished.
6. Diagrams and devices on local control panels shall be identified with engraved phenolic nameplates, white on black, minimum 1/4-inch (6 mm) high block capital lettering, screwed or bolted to panel or mounting plate face. Adhesive attachments are not acceptable.

2.18 WIRING

- A. General: Provide a complete system of electric wiring for temperature control apparatus including control power transformers and wiring to the transformer primary.
- B. All wiring shall be installed in conduit. Refer to Division-26 section, "Raceways." MC cable is prohibited in all locations.
- C. Wiring: Wire for low voltage AC shall be minimum 300 volt insulated copper No. 18 AWG or larger conforming to NFPA 70, Type MTW, THHN or TFFN, installed in accordance with Division-26 of these specifications.
 1. For low voltage DC and an electronic circuit carrying less than 0.5 amperes, cables of two or more conductors not smaller than No. 18 AWG solid copper or No. 18 AWG solid copper if not shielded may be used in lieu of individual wires.
 2. Cables carrying analog signals shall be shielded, if required by the manufacturer.
 3. Cables shall be terminated in solder or screw type terminal strips.
 4. Cables shall not be tapped at any intermediate points.
 5. All wire shall be color coded or numbered for identification. Identify as indicated on shop drawings and "as-built" drawings.
 6. Wire terminating in screw type terminal strips shall have pressure connectors conforming to UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," or UL 486B, "Wire Connectors for Use with Aluminum Conductors."
 7. Wire terminations without connectors or traveling pressure pads will not be accepted.
- D. The contractor shall in no case combine control wiring (line or low voltage) with power wiring in the same conduit.

2.19 ACCESSORIES

- A. Provide a PC based operator's workstation within the building at a location determined by the owner, including a flat screen monitor (minimum 21") and a color laser printer. Provide color graphics of all systems to be controlled, monitored and alarmed by the EMCS. Computer hardware and software shall be compatible with the most current version of the ATC vendor's software and graphics packages.

- B. Provide a portable operating terminal for connection to the main DDC control panel. In addition, main panel shall be provided with modem connection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wiring and Conduit: Provide wiring and conduit to connect the automatic control system components for an operational system.
 - 1. Provide wiring in accordance with requirements indicated in this section.
 - 2. Run conduit in straight lines, parallel to the lines of the building, and rack on factory furnished mounting blocks attached to the building structure. Where run buried in slabs provide long sweep rigid conduit bends extending 6 inches (150 mm) above the slab at slab penetrations.
 - 3. Do not bury or conceal wiring beneath building insulation.
 - 4. Locate wiring clear of access doors, accessible ceilings, lighting fixtures, walkways, or any location subject to damage or abrasion.
- B. Identification: Label or code each field wire at each end, and each controller and controlled device.
 - 1. Identification shall be permanent, robust, not subject to fading, and flameproof.
 - 2. Permanently mark terminal blocks at wire termination points.
 - 3. Identify each control device with an engraved laminated phenolic nameplate, white on black, lettering not less than 1/8-inch (3 mm) height, on 1-1/2-inch (40 mm) by 1-inch (25 mm) tag and brass interlocked chain secured to the control device. Name shall correspond with identification on the shop drawings.
 - 4. Identify sensors, controllers, relays, either mounted in local or central control panels, or remote mounted with a similar name tag as specified above. Attach to or adjacent to controllers with stainless steel or brass screws or rivets. Adhesives will not be acceptable. Do not attach to removable controller covers.
- C. Pipe Work: Mount strap-on sensors using helical screw stainless steel band clamp for strap-on thermostats, aquastats and other temperature switches on new piping for unit heaters and fan coil units after the pipe is cleaned to bright metal. Strap-on sensor may be used on piping up to 2-1/2-inch (65 mm) diameter. On pipe 3 inches (80 mm) and larger use pipe wells.
- D. Pipe Wells: Install pipe wells above the horizontal to retain liquid heat transfer fluid in the well.
- E. Valves: Install valves in piping with stems as vertical as possible but in no case less than 45 degrees from vertical. For soldered or welded connections, remove valve internals before mounting.
- F. Electric Valves: Wire electric valves in accordance with NFPA 70 with not less than 2 feet (610 mm) of flexible liquidtight connector with watertight bushings at the valve actuator. Brace conduit to the building structure.
- G. Pressure and Temperature Sensors: Install pressure and temperature sensors as follows.

1. Locate pressure and temperature sensing points sufficiently downstream from the control device to increase control loop time constant and minimize hunting.
 2. Locate shut-off valves and 3-valve bypasses as specified in "Sensors" paragraph of this Section.
 3. Locate sensors where accessible for maintenance and replacement.
 4. Do not cover or conceal sensors with insulation.
- H. Space Sensors: Install space sensors as follows.
1. Space sensor including space thermostats, aspirating thermostats, humidistats, pressure or differential pressure sensors shall be enclosed in cast brushed aluminum or 16 gauge (1.6 mm) brushed and ground stainless steel enclosures. Enclosures shall be tamperproof. Setpoint adjustment or settings shall not be visible or adjustable from outside sensor enclosure. Sensors shall be securely mounted and rigid.
 2. Locate room thermostats and other room sensors approximately 48 inches (1200 mm) above the floor (or otherwise as required to meet the most current ADA guidelines) on inside wall where they will respond to average conditions in the space.
 3. Sensors mounted on outside walls, if unavoidable, shall be mounted on factory made insulated brushed stainless steel bases.
 4. Provide thermostat/sensor guards in all areas subject to potential damage. Thermostat/sensor guards shall be clear, impact resistant lockable plastic or approved equivalent. Thermostat/sensor guards shall be provided in the following areas and other similar type spaces subject to potential damage: gymnasium, multi-purpose rooms, fitness areas, activity rooms, mechanical rooms, electrical rooms, etc.
- I. Air Handling Unit Temperature Indicators: For each factory assembled central station air handling unit and field erected air handling unit, provide temperature indicators in the following locations. In addition, unless indicated otherwise by the Owner, provide thermostat/sensor guards wherever students have access, including but not limited to: classrooms, corridors, cafeteria, media center, auditorium, etc.
1. Each outside air plenum.
 2. Each return air plenum.
 3. Each cooling coil inlet and discharge.
 4. Each heating coil discharge.
 5. Temperature indicators shall be so located that they may be read by an operator standing on the operator floor. Indicators more than 8 feet (2400 mm) above the floor shall be remote bulb type.
- J. Duct Sensors: Select duct sensor locations to properly sense average air conditions, minimize vibration, avoid dead air spaces, and within velocity limits required by the manufacturer.
1. Provide velocity shields where required.
 2. Securely mount or clamp averaging elements, maximum 3 feet (900 mm) on centers to the leaving side of coils and equipment. Insulate averaging elements from equipment and protect from vibration.
 3. Provide separate duct flanges for each sensing device.

4. Provide gaskets or sealant where elements penetrate duct walls.
 5. Mount sensor to allow easy removal and servicing without disturbing insulation or vapor barrier. Mount on standoff brackets to avoid condensation.
 6. Coordinate the location for duct access doors downstream from each duct sensor.
- K. Pipe Sensors: Provide wells for all sensors and indicators measuring temperatures in pressure vessels and piping.
1. Wells shall be stainless steel or bronze to match media requirements.
 2. Verify working pressure of sensor wells.
 3. Do not install wells in extension couplings.
 4. Where pipe diameters are smaller than the well length, provide wells at piping elbow or tees to affect flow across the entire well area.
 5. Wells may face upstream or downstream.
 6. Angle wells to retain thermal fluid within the well.
 7. Should wells restrict cross sectional pipe area to less than 70 percent free area, provide pipe increases at the well not less than 150 percent pipe diameter.
- L. The ATC contractor shall interface with smoke detectors, smoke dampers and fire alarm devices as required to accomplish equipment shutdown, alarms, etc., as indicated in sequences.
- M. For single phase motors, provide relays and/or contactors of appropriate horsepower and voltage rating as required to energize/de-energize equipment as indicated in sequences.

3.2 TEST PLAN

- A. Test Plan: Prepare a written test plan indicating in a step-by-step, logical fashion, the procedures by which the automatic control system will be tested, adjusted, and checked.
- B. Pre-Approval: Not less than six (6) weeks prior to testing, provide four (4) copies of the proposed test plan for approval. Meet and discuss the test plan, and make agreed changes to the written plan.
- C. Content: Plan shall include, as a minimum, for each system and sub-system of the automatic control work the following:
1. System name.
 2. List of devices with brief description of functional purpose of each.
 3. A description of the expected signal values transmitted by the sensor.
 4. A description of the expected signal values transmitted by the controller to the control device or actuator.
 5. A description of the expected values of the control medium from limit-to-limit.

6. A description of the instrumentation required to test the system.
7. A description of the expected field adjustments for transmitter, controller, and control actuator should control parameters fall outside of expected values.
8. A log sheet or sheets on which expected and field read values will be recorded and final field read values indicating that the system is operating in accordance with contract requirements.

3.3 TESTS DURING AND AFTER INSTALLATION

A. Instrumentation and Control: Calibration test each controller as follows:

1. Disconnect the sensor input signal to the controller and provide a compatible test signal generator.
2. Simulate expected transmitter values and input to the controller. Record controller branch line values.
3. Examine control device and determine that the device is responding.
4. Simulate maximum and minimum transmitter signal values and verify minimum and maximum controller output values and control device minimum and maximum stroke range.
5. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedule, proportional relationship, reset relationship, and derivative reaction.
6. When the controller and control device portion of each loop are responding as designed, reconnect the sensor transmitter input line.
7. After mechanical equipment control becomes operational, perform an operational test of each control loop recording sensor, transmitter, controller input, controller output and control medium parameter.
8. Entire test shall be witnessed by an owner's representative.
9. Upon satisfactory test a copy of final test results shall be bound in the operating and maintenance manual.

3.4 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.
- B. Comply with all applicable specification sections including, but not be limited to, "Basic HVAC Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A calibration verification report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.

- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A "Functional Performance Test Verification Form" is included at the end of this section. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to air handling unit, fan coil unit, DX cooling equipment, etc.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.5 DEMONSTRATION AND TRAINING

- A. Demonstration: After completion of testing as hereinbefore specified, provide demonstration and training of designated operating personnel (refer to Division-1).
 - 1. A demonstration shall be performed.
 - 2. Demonstration shall include the operation of the entire mechanical system under the control of the Contractor and shall include the start-up, operation, and shutdown of the system in accordance with the sequence of operation.
 - 3. The operation of each device shall be performed in accordance with the written instructions contained in the operation and maintenance manual, a copy of which shall be available ten (10) working days prior to the test. No deviation from procedures in the operating manual will be permitted.
- B. Failure to Perform: Should the system fail to perform in accordance with the requirements of the operation and maintenance manual, the system shall be repaired, recalibrated, retested as necessary, and a second demonstration performed.
 - 1. Subsequent demonstrations shall occur until the automatic control system and all associated mechanical and electrical equipment are operating in accordance with contract requirements.
 - 2. All testing, retesting, and recalibration shall be at no additional expense. The Contractor shall reimburse the expenses of the commissioning team for each test after the first.

3.6 INSTRUCTING OPERATING PERSONNEL

- A. Instructors and Superintendent: Upon completion of the work and acceptance by the representative of the Owner, provide the services of an Instructor, who together with the superintendent specialist shall instruct designated operating personnel in the operation and maintenance of the automatic control system.
 - 1. The services of the Instructor shall be available for not less than four 4-hour days of instruction.

2. The services of the superintendent specialist shall be available for not less than two 4-hour days.
3. Instructions shall be based upon the use of the operating and maintenance manual together with copies of the laminated control diagrams affixed adjacent to each local control panel.
4. Training and instruction will be witnessed. The witness shall monitor the entire training program and prepare a written report on the competency and effectiveness of instructors and the level of expertise of designated operators. A report will be submitted recommending additional training at additional cost, if such is deemed necessary.

3.7 BUILDING MANAGEMENT AND CONTROL SYSTEM DEVICES AND POINTS

- A. Provide all building management and ATC system controllers, devices, points, etc. as required to accomplish the control sequences and equipment functions indicated throughout the contract documents, including drawings and specifications. In addition, provide all controllers, devices, points, etc. as required to control, operate, monitor and alarm all equipment and devices indicated on the contract documents (including but not limited to: air handling units, split-system air conditioning units, valves, dampers, flow measuring devices, sensors, carbon monoxide (CO) detection devices, etc.). All points shall be available through the Energy Management Control System (EMCS). See attached points list (where applicable).
- B. Building management and control points shall include status for all mechanical equipment with equipment failures alarmed at the EMCS. In addition, furnish and install all points required to provide complete, color, system graphics of all mechanical systems and components indicated throughout the contract documents. All equipment and devices indicated throughout the contract documents shall be indicated at the operator's workstation (where applicable) and all end devices shall be individually controlled unless specifically indicated otherwise.
- C. Building management and control system features for equipment and devices shall include, but not be limited to, the following where applicable: runtime, trend data, optimal start, scheduling, paging, system graphics, and internet access to graphic and text-based displays.

END OF SECTION 230900

FUNCTIONAL PERFORMANCE TEST VERIFICATION FORM

Project Name:

FUNCTIONAL VERIFICATION FOR: _____ (Insert Equipment Name, i.e. AHU, etc.)					
SEQUENCE OF OPERATION		Controlling as Specified (Y/N)	ATC Technician Initials	Date	Notes
	(Insert complete sequence of operation as indicated in approved ATC submittal)				
	Example: Air Handling Unit Control				
	1. General:				
	1.1 Supply and return fans shall be interlocked. Fans shall operate continuously in the occupied mode. HOA switch shall be in the AUTO position.				
	1.2 Occupied-Unoccupied shall be as determined by the EMCS.				
	2. Temperature Control:				
	2.1 Occupied				
	A. When the outside air enthalpy is above the return air enthalpy, D-1, D-2 and D-3 shall modulate as follows:				

Page _____

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of hydronic piping work is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.
- B. Applications for hydronic piping systems include the following:
 - 1. Glycol supply and return
 - 2. Heating water supply and return

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hydronic piping products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects with hydronic piping work similar to that required for project.
- C. Codes and Standards:
 - 1. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 "Building Services Piping".

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for hydronic piping, materials and products.
- B. Shop Drawings: Submit scaled layout drawings as required by Division-23 Section, "Basic HVAC Requirements".
- C. Record Drawings: At project closeout, submit record drawings of installed hydronic piping and piping products.
- D. Maintenance Data: Submit maintenance data and parts lists for hydronic piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as

determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on hydronic piping systems maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

- A. General: Provide identification complying with Division-23 section "Identification for HVAC Piping and Equipment".

2.3 BASIC PIPES AND PIPE FITTINGS

- A. General: Provide pipes and pipe fittings complying with Division-23 section "Pipe, Tube and Fittings for HVAC Systems", in accordance with the following listing:
- B. Hydronic Piping:
 - 1. Tube Size 2" (50 mm) and Smaller: Copper tube; Type L, hard drawn temper; wrought-copper fittings with solder-joints.

2.4 BASIC PIPING SPECIALTIES

- A. General: Provide piping specialties complying with Division-23 section "Piping Specialties for HVAC Systems", in accordance with the following listing:
 - 1. Pipe escutcheons
 - 2. Pipeline strainers
 - 3. Dielectric fittings
 - 4. Drip pans
 - 5. Sleeves
 - 6. Sleeve seals

2.5 BASIC HANGERS AND SUPPORTS

- A. General: Provide hangers and supports complying with Division-23 section "Hangers and Supports for HVAC Piping and Equipment", in accordance with the following listing:
 - 1. Adjustable steel clevises, adjustable pipe saddle supports, single pipe rolls, and adjustable roller hangers, for horizontal piping hangers and supports.
 - 2. Two-bolt riser clamps, for vertical-piping clamps.
 - 3. Steel turnbuckles, for hanger-rod attachments.
 - 4. Concrete inserts, C-clamps, malleable beam clamps, and steel brackets, for building attachments.
 - 5. Protection saddles, for saddles and shields.

2.6 BASIC VALVES

- A. General: Provide valves complying with Division-23 section "Valves for HVAC Piping", in accordance with the following listing:
 - 1. Sectional Valves:
 - a. 2" (50 mm) and Smaller: Ball valves.
 - 2. Shutoff Valves:
 - a. 2" (50 mm) and Smaller: Ball valves.
 - 3. Balancing Valves:
 - a. Combination shut-off/balance valve with venturi type flow meter fitting with integral readout ports and memory stop. Provide ball valve for 2" (50 mm) and smaller
 - b. See Division-23 section "Hydronic Specialties" for balance valve specification.
 - 4. Drain Valves:
 - a. 2" (50 mm) and Smaller: Ball valves.
 - 5. Check Valves:
 - a. All sizes: Swing check valves.

2.7 BASIC EXPANSION COMPENSATION

- A. General: Provide expansion compensation products complying with Division-23 section "Expansion Compensation for HVAC Piping".

2.8 BASIC VIBRATION CONTROL

- A. General: Provide vibration control products complying with Division-23 section "Vibration Isolation for HVAC Piping and Equipment".

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which hydronic piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BASIC IDENTIFICATION

- A. General: Install mechanical identification in accordance with Division-23 section "Identification for HVAC Piping and Equipment".

3.3 INSTALLATION OF HYDRONIC PIPING

- A. General: Install hydronic piping in accordance with Division-23 section "Pipe, Tube and Fittings for HVAC Systems".
- B. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush.
- C. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.
- D. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.4 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with Division-23 section "Piping Specialties for HVAC Systems".

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with Division-23 section "Hangers and Supports for HVAC Piping and Equipment".

3.6 INSTALLATION OF VALVES

- A. Install valves in accordance with Division-23 section "Valves for HVAC Piping".
- B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two (2) or more hydronic terminals or equipment connections, and elsewhere as indicated.
- C. Shutoff Valves: Install on inlet and outlet of each mechanical equipment item, control valves, strainers and elsewhere as indicated.
- D. Balancing Valves: Install on outlet of each hydronic terminal, and elsewhere as indicated.
- E. Drain Valves: Install on each mechanical equipment item and locate to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hydronic piping system.

3.7 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS

- A. Install expansion compensation products in accordance with Division-23 section "Expansion Compensation for HVAC Piping".

3.8 EQUIPMENT CONNECTIONS

- A. General: Connect hydronic piping system to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union/flange connection on supply and return, and drain valve on drain connection.

- B. Hydronic Terminals: Install hydronic terminals with hydronic terminal valve and union on inlet and outlet. Install manual air vent valve on element in accordance with manufacturer's instructions. Locate valves and balancing cocks behind valve access doors for ease of maintenance. Where indicated, install automatic temperature control valve with unions between valve and element on supply line.

3.9 FIELD QUALITY CONTROL

- A. Piping Tests: Test hydronic piping in accordance with testing requirements of Division-23 section "Testing, Adjusting and Balancing."

3.10 CLEANING

- A. Cleaning, Flushing, and Inspecting: Clean, flush, and inspect hydronic piping systems in accordance with requirements of Division-23 section "Pipe, Tube and Fittings for HVAC Systems".

END OF SECTION 232113

SECTION 232115 - HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of hydronic specialties required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.
- B. Types of hydronic specialties specified in this section include the following:
 - 1. Balancing Valves
 - 2. Air Vents

1.2 QUALITY ASSURANCE

- A. Hydronic Specialty Types: Provide hydronic specialties of same type by same manufacturer.
- B. Codes and Standards:
 - 1. ASME Compliance: Manufacture and install hydronic specialties in accordance with ASME B31.9 "Building Services Piping".
 - 2. UL and NEMA Compliance: Provide electrical components of hydronic specialties which are listed and labeled by UL, and comply with NEMA standards.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of hydronic specialty. Include pressure drop curve or chart for each type and size of hydronic specialty. Submit schedule indicating manufacturer's figure number, size, location, rated capacities, and features for each required hydronic specialty.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, required clearances, and method of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of hydronic specialty. Include this data, product data, and shop drawings in Maintenance Manual.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following (unless otherwise noted):
 - 1. Bell and Gossett

2. Taco
3. Amtrol
4. Flow Design, Inc.

2.2 HYDRONIC SPECIALTIES

- A. General: Provide factory-fabricated hydronic specialties recommended for use in service indicated. Provide hydronic specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option, but more than one type cannot be used on project.

2.3 BALANCING VALVES

A. General:

1. Manual balancing devices shall be venturi type as defined by ASHRAE. Devices shall have a precision machined throat and have a stated catalog accuracy of 3% full scale and have an actual accuracy of $\pm 5\%$ of actual reading down to 10 in. w.c. pressure differential across the metering device. The induced differential reading (flow signal) shall be greater than two feet water column at the design flow with the valve in the wide open position. The permanent pressure loss at design flow shall not exceed two feet of water in the wide open position. The valves shall have differential readout ports fitted with check valve and protective cap, and are to have a memory stop to allow complete shut-off and return to set position without losing the setpoint.

B. Construction:

1. Valves 2" and Smaller: Brass ball valve, blowout proof stem, virgin Teflon seats, brass stems, stem seals and steel handles.

C. Minimum Ratings:

1. Devices with sweat or NPT connections: 400 psig (2760 kPa) at 250°F (121°C).
2. Devices with flanged connections: 125 psig (862 kPa) at 250°F (121°C) suitable for the system for which it is installed.

D. Readout Meter Kit:

1. Provide a portable readout meter kit by the manufacturer of the balancing devices. The meter shall be permanently mounted in a durable case complete with two 10' (3 m) color coded hoses with shutoff valves at the end that connects to the balance valve so that water does not drain out between readings. Meter shall have a 6" (150 mm) diameter face and 1.75% full rated accuracy. Meter for the venturi type devices shall be provided with a removable transparent face indicating flow directly in GPM for each size device furnished. Meter shall have a three valve manifold for over-range protection.

E. Installation:

1. The straight pipe required to achieve 3% full scale accuracy shall be incorporated as an integral part of the venturi and valve assembly. No additional straight piping shall be required.

2. Install in accordance with the manufacturer's instructions.
 3. Check connections after installation for leaks.
- F. Balancing valves shall be Flow Set model UA (2" and smaller) or EF (2-1/2" and larger) as manufactured by Flow Design or equivalent.

2.4 AIR VENTS

- A. Manual Air Vents: Provide manual vents designed to be operated manually with screwdriver or thumbscrew, 1/8" (3 mm) N.P.T. connection.
- B. Automatic Air Vents: Provide automatic vents at all high points of the heating and chilled water systems. All valves shall be cast brass, rated for 150 psig design pressure and 270°F operating temperature. Units to include non-ferrous floats, stainless steel linkage and a Viton seal which closes against a brass spring operated seat. Units shall come complete with a 20 year limited warranty against defects in materials and workmanship, which should be given to owner after installation. Automatic air vents shall be Spirotop as manufactured by Spirotherm or equivalent.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which hydronic specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner's representative.

3.2 INSTALLATION OF HYDRONIC SPECIALTIES

- A. Balancing Valves: Install venturi type balance valves at all hydronic coils and terminals including, but not limited to, fan coil units, unit ventilators, baseboard radiation, convectors, unit heaters, cabinet heaters, heating coils, cooling coils, etc. For four-pipe terminal units such as fan coil units and unit ventilators, provide balance valves at heating and cooling coil.
- B. Air Vents:
 1. Manual Air Vents: Install manual vents on each hydronic terminal at highest point, and on each hydronic piping drop in direction of flow for mains, branches, and runouts, and elsewhere as indicated. In addition, provide 1/2" ball valve with hose end connection, cap and chain at all high points within the piping system to accommodate manual venting of trapped air.
 2. Automatic Air Vents: Install automatic vents at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain, or as indicated.
- C. Low Point Drains: Provide a ball valve with hose end connection, cap and chain at all low points within the piping system to accommodate manual draining of water from the system. Drain valves shall be sized in accordance with the following criteria:
 1. For pipes smaller than 3", provide 3/4" ball valve.

END OF SECTION 232115

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of refrigerant piping work is indicated by requirements of this section and all other Division-23 sections.
- B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of refrigerant piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Specialist with at least five (5) years of successful installation experience on projects with refrigerant piping work similar to that required for project.
- C. Codes and Standards:
 - 1. ASME Compliance: Fabricate and install refrigerant piping in accordance with ASME B31.5, "Refrigeration Piping", and extend applicable lower pressure limits to pressures below 15 psig (100 kPa).
 - 2. IMC Compliance: Fabricate and install refrigerant piping in accordance with the applicable edition of the International Mechanical Code (IMC).
 - 3. IBC Compliance: Refrigerant piping shall be installed in accordance with the applicable edition of the International Building Code (IBC).
 - 4. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with the latest version of ASHRAE 15 "Safety Code for Mechanical Refrigeration".

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping materials and products.
- B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ASME B31.5).
- C. Shop Drawings: Submit scaled layout drawings of refrigerant pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.
- D. Maintenance Data: Submit maintenance data and parts lists for refrigerant piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

- A. General: Provide identification complying with Division-23 sections "Basic HVAC Materials and Methods" and "Identification for HVAC Piping and Equipment", in accordance with the following listing:
 - 1. Refrigerant Piping: Plastic pipe markers.

2.3 BASIC PIPES AND PIPE FITTINGS

- A. General: Provide pipes and pipe fittings complying with Division-23 sections "Basic HVAC Materials and Methods" and "Pipe, Tube and Fittings for HVAC Systems", in accordance with the following listing:
 - 1. All applications: Copper tube; Type ACR, hard drawn temper; wrought-copper fittings; brazed joints.
 - 2. Allowable for last ten (10) feet prior to indoor terminal unit (i.e. VRF terminal or split system indoor unit) connection: Copper tube; Type ACR, soft annealed temper; wrought-copper fittings, brazed joints.
 - 3. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-5 for brazing filler metal.

2.4 BASIC PIPING SPECIALTIES

- A. General: Provide piping specialties complying with Division-23 sections "Basic HVAC Materials and Methods" and "Piping Specialties for HVAC Systems", in accordance with the following listing:
 - 1. Pipe escutcheons
 - 2. Drip pans
 - 3. Sleeves
 - 4. Sleeve seals

2.5 BASIC HANGERS AND SUPPORTS

- A. General: Provide hangers and supports complying with Division-23 sections "Basic HVAC Materials and Methods" and Hangers and Supports for HVAC Piping and Equipment", in accordance with the following listing:
1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
 2. Two-bolt riser clamps for vertical piping supports.
 3. Concrete inserts, C-clamps, and steel brackets for building attachments.
 4. Protection shields for insulated piping support in hangers.
 5. Copper flashings for piping penetrations.

2.6 SPECIAL REFRIGERANT VALVES

- A. General: Special valves required for refrigerant piping include the following types. Provide extended valve handles to allow for full operation after insulation is applied:
1. Globe and Check Valves:
 - a. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300°F (149°C) temperature rating, 500 psi (3450 kPa) working pressure.
 - b. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F (121°C) temperature rating, 500 psi (3450 kPa) working pressure.
 2. Solenoid Valves:
 - a. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, 1/2" (13 mm) conduit adapter, 250°F (121°C) temperature rating, 400 psi (2720 kPa) working pressure.
 - 1) Manual Operator: Provide manual operator to open valve.
 3. Ball Valves:
 - a. Ball Valve with Access Port: Compatible with all CFC, HCFC and HFC refrigerants and oils, designed for pressures up to 775 psig, and temperature range of -40°F (-40°C) to 300°F (149°C), full port construction to match line size ID, internally equalized ball design, rupture-proof encapsulated stem, UL listed.
 - 1) Confirm compatibility with selected VRF/equipment manufacturer.

2.7 REFRIGERANT SPECIALTIES

- A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel, screen, 100 mesh, UL-listed, 350 psi (2380 kPa) working pressure.
- B. Moisture-Liquid Indicators: Forged brass, single port, removable polished optical glass, UL-listed, 200°F (93°C) temperature rating, 500 psi (3450 kPa) working pressure.
- C. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, UL-listed, 500 psi (3450 kPa) working pressure.
- D. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi (3450 kPa) working pressure.
- E. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
- F. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.

2.8 BASIC VIBRATION CONTROL

- A. General: Provide vibration control products complying with Division-23 sections "Basic HVAC Materials and Methods" and "Vibration Isolation for HVAC Piping and Equipment", in accordance with the following listing:
 - 1. Isolation hangers
 - 2. Riser isolators
 - 3. Riser support isolators
 - 4. Flexible pipe connectors

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF BASIC IDENTIFICATION

- A. General: Install mechanical identification in accordance with Division-23 sections "Basic HVAC Materials and Methods" and "Identification for HVAC Piping and Equipment".

3.3 INSTALLATION OF REFRIGERANT PIPING

- A. General: Install refrigerant piping in accordance with Division-23 sections "Basic HVAC Materials and Methods" and "Pipe, Tube and Fittings for HVAC Systems", in compliance with equipment manufacturer's recommendations, and in compliance with the applicable

edition of the International Mechanical Code (IMC) and the International Building Code (IBC).

- B. Install refrigerant piping with 1/4" per foot (6 mm per meter) (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.
 - 1. Exception: Do not pitch refrigerant piping for VRF systems, except when twinning condensing units together. When twinning VRF condensing units together, pitch the piping away from the condensing units. Otherwise VRF piping to be installed level and without oil traps. Where traps cannot be avoided, for every 1" of vertical drop, use 3X that in length to slope back up to horizontal plane.
- C. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.
- D. Bleed dry nitrogen through refrigerant piping during brazing operations.
- E. Refrigerant pipe penetrations through building assemblies shall be sealed to prevent the migration of refrigerant leakage. Penetrations shall be installed and sealed in accordance with the applicable editions of the IMC and IBC.

3.4 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with requirements of Division-23 sections "Basic HVAC Materials and Methods" and "Piping Specialties for HVAC Systems".

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Install supports and anchors in accordance with requirements of Division-23 sections "Basic HVAC Materials and Methods" and "Hangers and Supports for HVAC Piping and Equipment".

3.6 INSTALLATION OF SPECIAL REFRIGERANT VALVES

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before brazing, replace after joints are completed.
 - 1. Solenoid Valves: Install in refrigerant piping as indicated with stem pointing upwards.
 - a. Wiring of solenoid valves is specified in applicable Division-26 sections, and is included as work of this section.

3.7 INSTALLATION OF REFRIGERANT ACCESSORIES

- A. Refrigerant Strainers: Install in refrigerant lines as indicated, and in accessible location for service.
- B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines, in accessible location.

- C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated, and in accessible location for service.
- D. Evaporator Pressure Regulators: Install in refrigerant suction lines or evaporator outlets as indicated. Adjust, if required, for proper evaporator pressure.
- E. Refrigerant Discharge Line Mufflers: Install as indicated, in horizontal or downflow portion of hot-gas lines, immediately after leaving compressor; not in riser.

3.8 EQUIPMENT CONNECTIONS

- A. General: Connect refrigerant piping to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.9 FIELD QUALITY CONTROL

- A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ASME B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Refrigerant piping shall be pressure tested and evacuated in accordance with the system manufacturer's recommendations, and /or as follows (whichever is more stringent):
 - 1. Pressure Test (Air Tight Test): Pressurize the suction gas pipe, high/low pressure gas pipe and liquid pipe with dry nitrogen to a minimum pressure as per the system manufacturer. Pressure test duration shall be a minimum of 24 hours. If the pressure does not drop within the 24 hour period, the system passes. If there is a drop in pressure, check for leaks, make repairs and re-test as prescribed above.
 - 2. Evacuation Test (Vacuum Drying): Evacuate the system from the suction gas pipe, high/low pressure gas pipe and liquid pipe to a minimum vacuum pressure as per the system manufacturer. Vacuum pressure test shall be a triple evacuation test as outlined below. Upon failure of the test, the system may either contain moisture or have leaks, if so, make repairs and re-test as prescribed above.
 - a. Evacuate the system to 4,000 microns from both service ports, using a vacuum pump. Pressurize the system with dry nitrogen gas up to 0 psi from the discharge service port.
 - b. Evacuate the system to 1500 microns from the suction service port, using a vacuum pump. Pressurize the system with dry nitrogen gas up to 0 psi from the discharge service port.
 - c. Evacuate the system from both service ports, using a vacuum pump. After the vacuum reaches 500 microns, stop the vacuum pump and leave it for a minimum of 24 hours.
 - d. A vacuum of 500 microns must be maintained for at least 24 hours. The system pressure must not rise above 1500 microns during that time.
 - 3. The Contractor shall issue a certificate of testing to the authority having jurisdiction (AHJ) verifying strength test and leakage test in accordance with these specifications and the latest edition of ASHRAE Standard 15 for all systems containing 55 lbs. of refrigerant or more. The certificate shall give the test date, photographs of the pressure gauges at the test pressure, refrigerant designation, test medium, and the field test pressure applied to the high side and low side of

the system. The certification of testing shall be signed by the installing contractor and shall be made part of the public record.

4. Refer to the Refrigerant Leakage Test Summary Form to document test results. No other form will be acceptable. Submit results for all systems for review.

- B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.
- C. Refer to Division-23 section "Testing, Adjusting and Balancing" for additional specific test criteria and test form to be completed.

3.10 DEHYDRATION AND CHARGING SYSTEM

- A. Install core in filter dryer after leak test but before evacuation.
 1. Exception: if using a filter dryer in a VRF system, the filter dryer may only be used during startup, and must be isolated (ie.valved off) after use. Consult manufacturer guidelines.
- B. After completing the triple evacuation test outlined above, break vacuum with refrigerant gas and charge system to final charge amount as outlined in manufacturer's instructions.

3.11 ADJUSTING AND CLEANING

- A. Cleaning and Inspecting: Clean and inspect refrigerant piping systems in accordance with requirements of Division-23 section "Pipe, Tube and Fittings for HVAC Systems".

END OF SECTION 232300

SECTION 233113 - LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of low pressure ductwork is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections. Low pressure duct systems shall be defined as those duct systems which have an external static pressure (E.S.P.) of less than two-inches (2") water gauge (wg) (500 Pa). See schedules on drawings for external static pressure information.
- B. Types of low pressure ductwork which may be required for this project include the following:
 - 1. Return air ductwork
 - 2. Supply air ductwork (downstream of air terminal units or systems without air terminal units)
- C. Pressure Classification:
 - 1. All ductwork provided under this section shall be "Duct Pressure Class 2" as defined by SMACNA Standards.
- D. Duct Leakage Classification:
 - 1. All ductwork provided under this section shall be "Leakage Class 2", or better as required to meet maximum duct leakage requirements indicated in this section.

1.2 QUALITY ASSURANCE

- A. Installer: A firm with a minimum of five (5) years of successful installation experience on projects with low pressure ductwork systems similar to that required for project.
- B. SMACNA Standards: Comply with latest edition of SMACNA Standards for fabrication, storage and installation of low pressure ductwork. In addition, all new ductwork shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."
- C. ASHRAE Standards: Comply with ASHRAE Standards for fabrication and installation of low pressure ductwork.
- D. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems."
- E. Field Reference Manual: Have available at project field office, copy of SMACNA Standards - latest edition.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on manufactured products used for work of this section.

- B. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure as required by Division-23 Section, "Basic HVAC Requirements". Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect shop-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. All ductwork shall be shipped to the site with covered ends. The ductwork shall be covered with 3-mil (minimum) shrink wrap, with a minimum 2-inch overlap on all sides, to provide a water-tight seal at each opening. The covered ends shall remain intact until installation.
- C. Store ductwork, accessories and purchased products inside and protect from weather.
- D. Ductwork fittings and accessories stored on site for installation shall be covered with protective tarps and elevated a minimum of four inches until installed.
- E. Provide periodic (weekly) photographs of the jobsite storage to document that the ductwork is stored in accordance with the criteria outlined in this specification section.
- F. Lined ductwork not stored in accordance with the above criteria shall be replaced in its entirety. Unlined ductwork not stored in accordance with the above criteria shall be cleaned and inspected by the Owner's representative prior to installation. Contractor shall clean unlined ductwork to the satisfaction of the Owner, or replace at the Owner's discretion.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting. Provide interior lining or double wall duct as indicated on the drawings and/or these specifications.
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating.
- C. Stainless Steel Sheet: Where indicated (S/S), provide stainless steel complying with ANSI/ASTM A 167; AISI Type 302/304/316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.
- D. Aluminum Sheet: Where indicated (Al-), provide aluminum complying with ANSI/ASTM B 209, Alloy 3003, Temper H14.
- E. Copper Sheet: Where indicated (Cp-), provide copper complying with ANSI/ASTM B 370 cold-rolled, except where soft temper required for unusual forming.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of types and sizes indicated. Provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Duct Liner: Liner shall be one inch (25 mm) thick flexible, elastomeric, closed-cell, thermal insulation. The liner and adhesive assembly shall comply with NFPA 90A, 90B and UL 181. Liner shall not support microbial growth in accordance with ASTM C1071, ASTM G21 (fungal) and ASTM G22 (bacterial). Insulation Flame spread rating shall be listed and labelled to UL723 or ASTM-E84 to 25 or less flame spread rating and smoke developed rating shall be 50 or less. Liner shall be approved by Factory Mutual Research and shall be Armaflex Ultra or Armaflex Ultima as manufactured by Armacell or equivalent.
- C. Duct Liner Adhesive: Comply with Adhesive and Sealant Council, Inc. (ASC) and ASTM C916.
- D. Duct Liner Fasteners: Comply with SMACNA Standards. Fasteners shall not compress liner by more than 1/8".
- E. Duct Sealant: Non-hardening, non-migrating, oil based mastic or liquid elastic sealant (type applicable for fabrication and installation) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant shall be solvent (oil) based, water based or silicone based as follows:
 - 1. Solvent (oil) based sealant shall be used for indoor applications on all new construction installations. In addition, for indoor renovation projects, solvent (oil) based sealant shall be included in the contractor's bid and utilized wherever the sealant odor is not objectionable to the owner. Contractor shall coordinate with the owner's representative prior to the duct installation.
 - 2. Water based sealant shall be utilized for indoor renovation applications where the odor from solvent (oil) based sealant is objectionable to the owner. Contractor shall coordinate with the owner's representative prior to the duct installation.
 - 3. Silicone based solvent shall be utilized for all outdoor duct installation applications.
 - 4. Regardless of duct sealant type, maximum duct leakage requirements outlined in these Division-23 specifications shall be maintained.
- F. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- G. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
 - 1. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4" (6 mm) diameter or 3/16" (4.8 mm) thickness may be plain (not galvanized).
 - 2. For exposed stainless steel ductwork, provide matching stainless steel support materials.
 - 3. For copper ductwork, provide copper, bronze or brass support materials.
 - 4. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

2.3 FABRICATION

- A. Shop fabricate ductwork in 4 (1200 mm), 8 (2400 mm), 10 (3000 mm) or 12-foot (3600 mm) lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA Standards - latest edition.
- C. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Standards.
- D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to one and one-half times the associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.
- F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.
- G. Low pressure rectangular ductwork, fittings, etc., shall be constructed, installed and supported in accordance with current SMACNA Standards of gauges not less than the following:

<u>Maximum Side</u>	<u>Minimum Gauge</u>
Up to 12" (Up to 300 mm)	26 (.5 mm)
13" to 30" (325 mm to 750 mm)	24 (.7 mm)
31" to 60" (775 mm to 1500 mm)	22 (.8 mm)
61" to 84" (1525 mm to 2100 mm)	20 (1.0 mm)
Over 84" (Over 2100 mm)	18 (1.3 mm)

- H. All factory or shop fabricated ductwork shall be constructed as required to meet the testing requirements indicated in this section and Division-23 section "Testing, Adjusting and Balancing."

2.4 SPIRAL DUCTWORK

- A. Spiral duct shall have locked seams equivalent to United McGill "Uni-Seal," so made as to eliminate any leakage under the pressures for which this system has been designed. Spiral duct shall be manufactured of galvanized steel meeting ASTM A-527 by the spiral lockseam method and in the minimum gauges listed:

<u>Diameter</u>	<u>Minimum Gauge</u>
3" thru 26" (75 mm thru 650 mm)	26 (.5 mm)
28" thru 36" (700 mm thru 900 mm)	24 (.7 mm)
38" thru 50" (950 mm thru 1250 mm)	22 (0.8 mm)
52" thru 60" (1300 mm thru 1500 mm)	20 (1.8 mm)
62" and larger (1550 mm and larger)	18 (1.2 mm)

1. All fittings are to have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct sections. Fittings and couplings shall be of the following minimum gauges:

<u>Diameter</u>	<u>Minimum Gauge</u>
3" thru 26" (75 mm thru 650 mm)	24 (.7 mm)
28" thru 36" (675 mm thru 900 mm)	22 (1.0 mm)
38" thru 50" (950 mm thru 1250)	20 (1.0 mm)
52" thru 60" (1300 mm thru 1500)	18 (1.2 mm)
62" and larger (1550 mm and larger)	16 (1.4 mm)

2. Branch fittings supplying linear bar diffusers shall be "lo-loss" conical type saddle taps.
3. All 90 degree tees and 45 degree laterals, either full size or reducing, shall be conical pattern for 90 degree and straight pattern for 45 degree laterals, produced by machine or press forming. The entrance shall be free of weld build-up, burrs or irregularities. Provide tangential tees where required.
4. Elbows in diameters 3" (75 mm) through 12" (300 mm) shall be two section die-stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a centerline radius of 1.5 times the cross section diameter. All elbows not die-stamped shall be fabricated according to the following schedule:

<u>Elbow Angle</u>	<u>Number of Gores</u>
Less than 45°	2
46° thru 60°	2
Over 61°	3

5. The reduction of divided flow fittings shall be conical spun section in the thirty-six reductions in sizes 4" (100 mm) through 22" (550 mm).
6. Spun bellmouth connections shall be used at each round take-off from the high pressure plenum.
7. Offset fittings shall be constructed so that length of offset is not less than two (2) duct diameters.
8. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint, minimum two (2) coats.
9. Supports and sealants shall conform to applicable portions of SMACNA.
10. Flexible ductwork shall be as previously specified for low pressure duct systems.

2.5 FLEXIBLE DUCTWORK

- A. General: Provide insulated flexible ductwork where indicated on drawings, as manufactured by Flex Master Type 6B, or equivalent. Flexible ductwork shall be in compliance with UL-181 Class 1 Air Duct, fabricated with an acoustically transparent nylon inner fabric.

1. Liner: Nylon fabric, mechanically locked without adhesives.
2. Helix: Corrosion resistant galvanized steel; formed and mechanically locked to fabric.
3. Vapor Barrier: Black fire retardant, polyethylene.
4. Insulation: 1" thick. R-value of 6.0.

5. Pressure Rating: 6" wg positive.

Sound Attenuation: Flexible ductwork shall have minimum sound attenuating capabilities as indicated below for nominal three feet of straight duct:

Duct Diameter	Insertion Loss (db)					
	125	250	500	1000	2000	4000
	(2)	(3)	(4)	(5)	(6)	(7)
6	9	10	11	12	12	12
8	9	9	10	10	12	12
10	9	9	9	10	11	10
12	9	8	8	9	11	8

2.6 OUTDOOR DUCTWORK

- A. All outdoor ductwork shall be double walled duct with 2" flexible elastomeric liner. In addition, duct shall be provided with an outdoor duct insulation system (see Division-23 section "HVAC Insulation" of these specifications) suitable for outdoor applications and U/V exposure. Provide aluminum saddles between duct insulation and duct supports to protect insulation. Contractor shall fasten ductwork to equipment supports as required to withstand windloading. Design of fastening system to withstand windloading shall be approved by a registered structural engineer.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

- A. General: Assemble, install, support and seal ductwork in accordance with recognized industry practices which will achieve air tight (not to exceed 1% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" (3 mm) misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.
- B. Seal ductwork to SMACNA Standard Seal Class "A" and provide additional sealant as required to meet duct test requirements of this section.
- C. Install concrete inserts as required, for support of ductwork in coordination with formwork, as required to avoid delays in work.
- D. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" (25 mm) clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- F. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four (4) sides by at least 1-1/2" (40 mm).
- H. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- I. Support ductwork in manner complying with SMACNA Standards - latest edition of hangers and supports section.
- J. Unless indicated otherwise, all stainless steel ductwork shall be welded.
- K. Where vapors will be exhausted (dishwasher, cart wash, tunnel wash, canopy hood over sterilizers, etc.), ductwork shall be sloped back toward the source of moisture.
- L. All exposed ductwork (in non-mechanical rooms) shall be primed and painted with paint appropriate for sheet metal surfaces. See architectural section "Painting".
- M. Provide gasketed duct access doors as required to provide maintainable access to the upstream side of coils, humidifiers, etc.

3.2 INSTALLATION OF LINED DUCTWORK

- A. Provide lined ductwork at the following locations, and as otherwise indicated:
 - 1. All ductwork (supply, return, conditioned outside air, DOAS/ERU exhaust return) within the Mechanical Room.
 - 2. All ductwork within 25 feet upstream and downstream of air handling equipment (in all directions, including all duct branches and mains within 25 feet of equipment), including return air fans, with the exception of unconditioned outdoor air intake ductwork.
 - 3. Supply air ductwork downstream of air terminals.
 - 4. All air transfer ductwork, unless otherwise indicated.
- B. Dimensions on drawings indicate inside clear dimensions.
- C. Fiberglass liner exposed to the air stream shall not be utilized for outdoor air intake ductwork.
- D. Where ductwork is exposed to view in occupied areas, rectangular ductwork shall be lined and round ductwork shall be double wall duct with internal lining, unless otherwise noted.

3.3 INSTALLATION OF FLEXIBLE DUCTWORK

- A. Where indicated, provide factory insulated flexible ductwork between low pressure supply ductwork and round inlet ceiling diffusers. Provide side take-off fitting with damper (Flexmaster USA, model STOD or equivalent) between the flexible duct and the low pressure supply ductwork. Extend rigid sheet metal ductwork between the fitting and the flexible ductwork as required. The maximum length of flexible duct shall be 3' - 0" (915 mm).

- B. Connections to round neck diffusers shall include a rigid 45 degree sheet metal elbow at the diffuser inlet.

3.4 CLEANING AND PROTECTION

- A. Prior to installation, thoroughly clean ductwork internally of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or might interfere with painting or cause paint deterioration.
- B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.
- C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, install sheet metal temporary closures which will prevent entrance of dust and debris until the time all connections are to be completed.
- D. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.5 DUCT TESTING

- A. Prior to the balancing of systems by the AABC certified balancing contractor, all low pressure ductwork shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1%. In addition, current SMACNA and AABC Standards shall apply, where applicable, to meet the maximum 1% leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:
 - 1. Ductwork systems less than 2.0 in. wg E.S.P.: Test to 2 in. wg
- B. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.
- C. The balance contractor shall witness and certify all duct pressure tests.
- D. Contractor shall submit duct leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Duct test results shall be recorded on the "Air Duct Leakage Test Summary Form" located at the end of Section 230593; no other forms will be accepted. In addition, the duct leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the duct test section (each duct test section shall be numbered and color coded).
- E. All duct leakage test results shall be included with the final TAB report and the O&M Manual. The orifice tube calibration chart shall also be included with the final duct leakage test report information.

3.6 BALANCING

- A. Refer to Division-23 section "Testing, Adjusting and Balancing" for air distribution balancing of low pressure ductwork; not work of this section.

END OF SECTION 233113

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections.
- B. Types of ductwork accessories required for project include the following:
 - 1. Dampers:
 - a. Low pressure manual dampers
 - 2. Fire and smoke dampers
 - 3. Duct hardware
 - 4. Duct access doors
 - 5. Penetration seals
- C. Duct Cleaning: Each of the following HVAC systems listed shall be cleaned and sanitized in their entirety:
 - 1. All existing supply ductwork
 - 2. All existing outside air ductwork
 - 3. All existing air handling units and associated fans

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. SMACNA Compliance: Comply with applicable portions of latest edition of SMACNA Standards. In addition, all duct accessories shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."
 - 2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
 - 3. UL Compliance: Construct, test, and label fire, smoke and combination fire/smoke dampers in accordance with UL Standards 555 and 555S.
 - 4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.
- B. Duct Cleaning Contractor:

1. Duct cleaning contractor shall have been regularly engaged in commercial type duct cleaning services for a minimum of five (5) years of successful operation.
2. NADCA Certified: The duct cleaning contractor shall be certified by the National Air Duct Cleaners Association (NADCA).

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, materials of construction and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
- C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual.
- D. Duct cleaning contractor shall submit proposed approach, methodology and detailed cleaning and sanitizing process for each system listed above for approval prior to work being performed. In addition, provide documentation of NADCA certification, as well as five (5) years of successful performance.

PART 2 - PRODUCTS

2.1 DAMPERS

- A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with the latest edition of SMACNA Standards. Provide insulation stand-off bracket as required to compensate for external duct insulation. Air pressure drop shall not exceed 0.10" at 1500 FPM.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fire Dampers: Provide fire dampers where indicated and where required by NFPA and local authorities. Provide Type "C" fire dampers. Construction shall be in accordance with NFPA 90A and UL 555, and be UL labeled accordingly. Provide fusible link rated at 160°F to 165°F (71°C to 74°C) unless otherwise indicated. Provide damper with positive lock in closed position. Damper blades shall be fully out of the air stream. Horizontal installations shall have damper blades and closure spring out of air stream. Provide the following features:
 1. Damper Blade Assembly: Curtain or multiple blade type.
 2. Blade Material: Match casing and ductwork where installed.
 3. Provide factory sleeve. Construction shall be minimum 20 gauge. Should duct be heavier than 20 gauge, provide sleeve and frame to match duct and material construction. Sleeves shall be sufficient in length to protrude on both sides of the wall to allow for access door on one side and UL approved breakaway duct connection on both sides.
- B. Combination Fire/Smoke Dampers: Provide motor driven fire/smoke dampers in types and sizes indicated and where required by NFPA and local authorities as indicated on the drawings. Dampers shall be multi-blade type with frames and blades constructed of galvanized steel. Dampers shall be UL 555 and 555S

listed with Class I leakage characteristics at 250°F (8 CFM/ft² at 4" WG). Dampers located in medium pressure systems shall have air foil blades. Dampers in low pressure systems are to be standard "V" groove type. Dampers shall have factory sleeves meeting the requirements of UL. Electric actuators shall be provided by the damper manufacturer and installed at the factory externally on the damper sleeve. Actuators shall be UL approved as an assembly with the damper. Provide end position indicator switches for use by ATC. Duct type smoke detectors shall be furnished under Division-28.

1. Coordinate the damper voltage with the smoke/duct detector relay voltage.
 2. See drawings for additional information regarding wiring of smoke and fire/smoke dampers.
- C. Fire and /or combination fire smoke dampers shall be provided at all duct penetrations through fire/smoke rated partitions and damper shall be provided to match the assembly fire hour rating. Contractor shall refer to architectural plans for all wall assemblies and ratings.
- D. Smoke Dampers:
1. Ratings:
 - a. Smoke Rating: Leakage in accordance with UL 555S.
 - 1) SD-141 – Leakage Class-1 (8 cfm/ft² (0.04 m³/ s/m²) at 4 in. wg. (1.0 kPa)
 - b. Elevated Temperature Rating: 350°F (177 °C)
 - c. Air Flow Rating: 2000 fpm (15.3 m/s)
 - d. Differential Pressure Rating: 4 in. wg. (1.0 kPa)
 2. Construction:
 - a. Frame: Hat-shaped channel, roll formed galvanized steel with interlocking gusseted corners. Structurally equivalent to 13 gauge (2.3 mm) U-channel type frame. Low profile head and sill on sizes less than 13 inches (330 mm) high.
 - b. Blades: 6 inch maximum width x 16 gauge (152 mm x 1.6 mm), 3-V shape, roll formed galvanized steel.
 - c. Blade Seals: Silicone rubber permanently bonded to blade.
 - d. Jamb Seals: Stainless steel, flexible metal compression type.
 - e. Axels: Minimum ½" (13mm) diameter plated steel hex-shaped, mechanically attached to blade.
 - f. Bearings: Self-lubricating stainless steel, sleeve-type turning in extruded hole in frame.
 - g. Linkage: Concealed in frame.
 - h. Mounting: Vertical and/or Horizontal
 - i. Sleeve: Minimum 16 inches long x 20 gauge (406 mm x 1.0 mm), factory installed.
 - j. Actuator:

- 1) Type: Electric 24V, 60 Hz, two-position, fail close.
- 2) Mounting: External.

2.3 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 1. Test Holes: Provide duct test holes in ductwork at fan inlet and outlet, and elsewhere as indicated, consisting of slot and cover, for instrument tests.
 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12" (300 mm). Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.4 DUCT ACCESS DOORS

- A. General: Provide duct access doors where required for duct accessory access. Provide access doors for fire dampers, smoke dampers and smoke detectors. Install access doors upstream of duct type smoke detectors.
- B. Construction: Construct of same or greater gage as ductwork served and provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork and extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12" (300 mm) high and smaller, 2 handle-type latches for larger doors.

2.5 FLEXIBLE CONNECTIONS

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flame retardant fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.6 PENETRATION SEALS

- A. Provide seals for all openings through fire-rated walls, floors or ceilings used as passage for mechanical components such as ductwork. See Division-23 section "Basic HVAC Materials and Methods" for penetration seals and firestopping requirements.
- B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Provide fire dampers where ducts penetrate a floor slab, and elsewhere as indicated. Dampers shall be provided to match wall and floor assembly ratings per the architects drawings.
- C. Install balancing dampers where indicated, and at each ducted air inlet and outlet. Dampers are not required where a single air outlet occurs downstream of an air terminal (VAVs, fan powered boxes, etc.).
- D. Install turning vanes in square or rectangular elbows (45 degrees and greater) in supply, return and exhaust air systems, and elsewhere as indicated.
- E. Install airtight access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Duct access panels shall be adequately sized to provide access to all fire and/or smoke damper fusible links.
- F. All electrical connections to smoke damper actuators and smoke detectors (duct or ceiling mounted) shall be provided by the ATC contractor.
- G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 DUCT CLEANING

- A. Prior to cleaning or sanitizing ductwork/equipment, all equipment utilized to perform those processes shall be sanitized. Examine ductwork/equipment prior to performing work and provide new duct openings where required to provide visual inspection of the duct interior.
- B. Unless indicated otherwise, the systems shall be cleaned and sanitized in the following order:
 - 1. Exhaust systems
 - 2. Return systems
 - 3. Air handling unit(s)
 - 4. Air handling unit supply systems
- C. Duct cleaning of the above systems listed shall include air devices, terminal reheat units, etc.
- D. Cleaning Process:
 - 1. General:
 - a. Systems shall be de-energized while duct cleaning and sanitizing are in progress.
 - b. HEPA filter vacuums shall be used to keep room air clean. Ceiling tile shall be handled with care, and repaired or replaced as required to restore to the original condition.
 - 2. Air Handler Cleaning Procedures:

- a. Vacuum completely, beginning with the area upstream of the filters. Filters shall be replaced at the completion of the work.
 - b. Vacuum the fan and fan chamber.
 - c. Wash/degrease fan blades as required.
 - d. Wash/degrease chamber upstream of the coils as required.
 - e. Clean coils.
 - f. Sanitize.
3. Coil Cleaning Procedure: The procedure shall be customized to the situation encountered. The most heavily soiled coils may take a more complicated procedure of solution/pressure spraying. Most require only low pressure application of special cleaning solution and rinsing after they are first fully vacuumed.
 4. Furniture Coverage from Incidental Dirt: As required, drape surrounding instruments, computers and areas with plastic to protect them from any incidental dirt generated during the cleaning process. Work environment shall be clean at all times. Floor shall be vacuumed as needed.
 5. Duct Cleaning: Cleaning shall be accomplished by mechanical means in conjunction with the use of High CFM HEPA style vacuums and three (3) filtered canister vacuums. Mechanical means may include vacuum brushing of the duct interior, auger style mechanical devices, or high pressure air activated in duct cleaning devices to scrape off any dirt adhered to duct walls. Cleaning may be accomplished by a combination of these methods. Where possible, clean a full run or section before beginning another to insure full cleaning coverage. All material in the vacuum shall be disposed of daily after being treated with a sanitizer.
 6. Sanitizing Process: Sanitizing shall be accomplished in two stages. First, it shall be done as each section of the air system is cleaned. The sanitization process shall be repeated again after the complete system has been cleaned. All sanitizing shall be completed before access is sealed. Diffusers shall be cleaned and sanitized. EPA recognized/registered sanitizers only shall be used. MSDS information shall be supplied for materials selected. Sanitizers/encapsulants shall not be used as a substitute for proper cleaning.
 7. Clean Tests: Tests for bacteria/fungi shall be performed after all cleaning and sanitizing is completed to insure the clean standards have been met. This shall be done while the system is in operation and shall be a minimum of forty-eight (48) hours after the last sanitation has been completed.
 8. Closing and Sealing: Provide galvanized sheet metal plate(s) to be used as access for the majority of locations. Square cut 22 gauge metal shall be used with each plate to lap its edges by one inch all around. Screws shall be placed at four inch (100 mm) intervals and the plate shall be sealed with a water-based fireproof sealant to ensure proper seal of the system to match existing pressure classification.
 9. Encapsulation: There may be times when it is necessary to use an encapsulant on interior lined duct. It should be used only if circumstances require it (for example, the lining may be breaking down), and shall be agreed to in advance by the client. It shall not be used as a substitute for cleaning.
 10. Duct cleaning shall be performed by Applied Building Technologies, Inc. or equivalent.

3.4 FIELD QUALITY CONTROL

- A. Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.5 ADJUSTING AND CLEANING

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper operation.
 - 1. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting and Balancing."
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- C. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.6 EXTRA STOCK

- A. Furnish extra fusible links to the Owner; one (1) link for every ten (10) installed of each temperature range.

END OF SECTION 233300

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section and all other Division-23 sections.
- B. Types of air outlets and inlets required for project include the following:
 - 1. Registers and grilles

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
 - 4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
 - 5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, Noise Criteria (NC) levels, static pressure loss, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to the following:
 1. Titus
 2. Krueger
 3. Price
 4. Nailor
 5. Anemostat
 6. Metalaire / Greenheck

2.2 REGISTERS AND GRILLES

- A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide registers and grilles that have, as a minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Surface Compatibility: Provide registers and grilles with border styles that are compatible with adjacent surfaces, and that are specifically manufactured to fit with accurate fit and adequate support. Refer to

general construction drawings and specifications for types of construction which will contain each type of register and grille.

- D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Register and Grille Materials:

- a. Steel Construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.
- b. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.

2. Register and Grille Faces:

- a. Horizontal Fixed Blades: Horizontal blades, fixed at 35 degrees, with 3/4" (20 mm) spacing. Blades shall be parallel to long dimension.
- b. Aluminum Grid - Eggcrate type: 1/2" x 1/2" x 1/2" (13 mm x 13 mm x 13mm) aluminum grid and border.

3. Register and Grille Patterns:

- a. Single Deflection
- b. Double Deflection

4. Register and Grille Finishes:

- a. Aluminum Enamel: Air-dried aluminum enamel prime finish.
- b. White Enamel: Semi-gloss white enamel prime finish.
- c. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions. Air outlets and inlets shall be independently supported from the structure at two (2) locations and in accordance with recognized industry practices to ensure that products serve intended functions. The ceiling or ceiling grid shall not be considered as a means of support.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.
- D. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

END OF SECTION 233700

SECTION 238119 – SPLIT SYSTEM AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Extent of split system air conditioning unit work required by this Section is indicated on drawings and schedules, by requirements of this Section, and all other Division-23 Sections.
- B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide split system air conditioning units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be field fabricated.
- B. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.
- C. Codes and Standards: Provide split system air conditioning units conforming to the following:
 - 1. Air-Conditioning and Refrigeration Institution (ARI): Comply with ARI 240.
 - 2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - 3. National Electrical Manufacturers Association (NEMA): Provide electrical components required as part of split system air conditioning units, which comply with NEMA Standards.
 - 4. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" as applicable to installation and electrical connections of ancillary electrical components of split system air conditioning units.
 - 5. Underwriters Laboratories, Inc. (UL): Provide electrical components required as part of split system air conditioning units, which have been listed and labeled by UL.
- D. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for air conditioning units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.
- B. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list. Include this data,

product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver split system air conditioning unit with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handling: Handle split system air conditioning units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units with new units.
- C. Storage: Store split system air conditioning units in a clean, dry place and protect from weather and construction traffic.
- D. Unloading: Comply with manufacturer's rigging instructions for unloading air conditioning units and condensing units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work will be limited to:
 - 1. Mitsubishi
 - 2. Trane

2.2 SPLIT SYSTEM AIR CONDITIONING UNITS

- A. General: Provide factory assembled air conditioning system complete with split system compact wall mounted packaged evaporator section and matching outdoor unit. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. All wiring shall be in accordance with the National Electrical Code (NEC). The units shall be rated in accordance with ARI Standard 240 and bear the ARI label. A full charge of R-454B for 100 feet of refrigerant tubing shall be provided in the condensing unit. A dry nitrogen holding charge shall be provided in the evaporator. System SEER shall meet or exceed 1992 Federal Standards.
- B. Capacities: Provide split system air conditioning units of capacity and type as indicated on the drawings and schedules.
- C. Warranty: The units shall have a manufacturer's warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced at the contractor's expense. Manufacturer shall have ten (10) years' experience in the U.S. market.
- D. Components: Provide split system air conditioning units that draw air through filter and coils, and that include fans, compressors, cooling coils, reheat coils, filters, remote air cooled condensing units, motors, starters, controls, and all other components necessary for proper operation.

1. Units shall be furnished complete with remote air cooled condensing unit factory assembled and tested by manufacturers of split system air conditioning units.
 2. For units installed above ceiling, provide a secondary drain pan with leak detection. Leak detection shall alarm at the building automation system (BAS) and shall de-energize the unit.
- E. Indoor Evaporator Unit: The indoor multi-position evaporator unit shall be factory assembled and wired. The casing shall be pre-painted, pre-insulated, 22 gauge galvanized steel or utilize black ZAM steel, and shall have a black finish. The evaporator fan shall be an assembly with line flow fans direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings. The cabinet shall include a fixed bottom return, a fixed vertical discharge supply. Return air shall be filtered by means of an easily removable washable filter. The evaporator coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phosphor copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The unit electrical power shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
- F. Control System: The control system shall consist of two (2) microprocessors interconnected by a single non polar two wire cable as supplied. Wiring shall run from indoor unit to controller direct. NO SPLICES. When running longer lengths or more than one (1) set of remote controller wires together, a double insulated, two wire cable equivalent to that provided e.g. Belden 9407 cable, is mandatory or use shielded two-wire cable. One (1) microprocessor shall be factory wired and located within the indoor unit. It shall have the capability of sensing return air temperature and indoor coil temperature; receive and process commands from the remote controller; provide emergency operation; and control the outdoor unit. The microprocessor within the wall mounted remote controller shall provide automatic cooling; display setpoint and room temperature; a 24 hour on/off timer so that automatic operation can be set on the timer at one (1) hour intervals from one to twenty-four hours; have self-diagnostic function display; check mode for memory of most recent problem; control system shall have control continued operation of the air sweep louvers; and provide on-off and system/mode function switching. Normal operation of the remote controller provides individual system control in which one (1) remote controller and one (1) indoor unit are installed in the same room. The remote controller shall have the capability of controlling up to a maximum of fifty (50) systems at a maximum developed control cable distance of 1,650 feet. The control voltage between the remote controller and the indoor unit shall be 12 volts D.C. The control voltage between the indoor unit and the outdoor unit shall be 12 volts D.C. Both 12VDC shall be generated from the indoor unit microprocessor board. The system shall be capable of automatic restart when power is restored after power interruption. System shall include twenty (20) function self-diagnostics including total hours of compressor run time.
1. Provide network interface controller (ie. network adaptor, network interface card, etc.) as required to interface the split system air conditioning unit (s) with the Building Automation System (BAS).
- G. Outdoor Unit: The outdoor unit shall be completely factory assembled, piped and wired. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel. The unit shall be furnished with one (1) direct drive, propeller type fan arranged for horizontal discharge. The motors shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation. The fans shall be provided with a raised guard to prevent contact with moving parts. The compressor shall be of the high performance rotary type with crankcase heater, accumulator and internal thermal

overloads. The compressor shall be mounted so as to avoid the transmission of vibration. The refrigeration system shall be equipped with high pressure switch and have the capability to operate with a maximum height difference of 100 feet and overall refrigerant tubing length of 100 feet between indoor and outdoor sections without the need for line size changes, traps or additional oil. Refrigerant flow from the condenser to be controlled by means of a capillary tube. The condenser coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with smooth plate fins bonded to copper tubing. The coil shall be protected with an integral metal guard. The unit shall be controlled by the microprocessor located in the indoor matching unit. A built-in, low ambient controller will allow cooling to 0 degrees F outdoor temperature. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

- H. Wind Baffle: To allow cooling operation in temperature down to zero degrees Fahrenheit, a wind baffle must be installed onto the condensing unit.
- I. Electrical Wiring: Provide all electrical circuits in conformance with NFPA 70 and color coded for ease in field tracing.
- J. Provide five (5) year parts and labor warranty for A/C condensing units.

PART 3 - EXECUTION

3.1 SPLIT SYSTEM AIR CONDITIONING UNIT INSTALLATION

- A. General: Install split system air conditioning units where indicated on the drawings in accordance with equipment manufacturer's published installation instructions.
- B. Access: Provide access space around split system air conditioning units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.
- D. Refrigerant Piping: Provide field installed refrigerant piping in accordance with Division-23 section, "Refrigerant Piping."
 - 1. Field installed refrigerant piping shall be refrigerant grade, Type L seamless copper tubing.
 - 2. All connections and joints shall be brazed.
 - 3. Pipe sizing and installation details shown on drawings shall be verified by the manufacturer. Piping shall be installed in strict accordance with manufacturer's recommendations regarding sizing and installation details.
- E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings.

3.2 START-UP

- A. General: Start and adjust all units installed under this specification under the supervision of an authorized factory trained representative of the manufacturer of each unit. Perform operational checks to make certain that controls and safety devices and systems are

operating properly. If defects or improper adjustments are found, they shall be corrected and tests repeated.

1. An operational check shall be made to demonstrate compliance with contract requirements, including but not limited to, capacity and control accuracy.
2. A report signed by each factory representative shall be submitted showing test conditions and results.

END OF SECTION 238119

SECTION 238123 - COMPUTER ROOM AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Extent of computer room air conditioning unit work required by this Section is indicated on drawings and schedules, by requirements of this Section, and all other Division-23 Sections.
- B. Refer to the requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide computer room air conditioning units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be field fabricated.
- B. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.
- C. Codes and Standards: Provide computer room air conditioning units conforming to the following:
 - 1. Air-Conditioning and Refrigeration Institution (ARI): Comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."
 - 2. Air Movement and Control Association, Inc. (AMCA): Comply with AMCA 210, "Laboratory Methods of Testing Fans for Rating Purposes."
 - 3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - 4. National Electrical Manufacturers Association (NEMA): Provide electrical components required as part of computer room air conditioning units, which comply with NEMA Standards.
 - 5. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" as applicable to installation and electrical connections of ancillary electrical components of computer room air conditioning units.
 - 6. Underwriters Laboratories, Inc. (UL): Provide electrical components required as part of computer room air conditioning units, which have been listed and labeled by UL.
- D. Commissioning Tests: Computer room air conditioning units shall meet commissioning requirements of paragraphs in Part 3 of this Section.

1.3 SUBMITTALS

- A. Conform to the requirements of Division-01Section, "Submittals," where applicable.
- B. Product Data: Submit manufacturer's product data for air conditioning units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.

- C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver computer room air conditioning unit with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handling: Handle computer room air conditioning units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units with new units.
- C. Storage: Store computer room air conditioning units in a clean, dry place and protect from weather and construction traffic.
- D. Unloading: Comply with manufacturer's rigging instructions for unloading air handling units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:
 - 1. Vertiv / Liebert
 - 2. Approved Equal

2.2 FLOOR MOUNTED COMPUTER ROOM AIR CONDITIONING UNITS

- A. General: Provide air handling units of factory assembled packaged unitary type specifically designed for computer room installation.
- B. Components: Provide air handling units that draw air through filter and coils, and that include fans, refrigeration system, coils, filters, motors, starters, controls, and all other components necessary for proper operation.

C. PERFORMANCE REQUIREMENTS

- 1. Capacities and Operating Conditions: Refer to equipment schedules on the Drawings.
- 2. Seismic Performance: Not required.

D. GLYCOL WATER COIL

- 1. Hydrophilic-Coated Evaporator Coil
 - a. The chilled-water tilted-slab cooling coil shall be two rows or four rows deep, as necessary. The cooling coil shall have a maximum face velocity of 500 FPM at 3500 CFM. The coil shall be constructed of copper tubes and hydrophilic coated aluminum fins.

- b. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. A stainless steel condensate drain pan shall be provided to allow the removal of moisture from the cooling coil.
 - c. The water circuit shall be filled with a nitrogen holding charge and spun shut. Field relief of the Schrader valve shall indicate a leak-free system.
 - 2. Control Valve
 - a. Two-Way Motorized Ball Valve: A two-way pre-piped motorized ball valve shall control the chilled water flow through the cooling coil. The Liebert iCOM shall manage the valve actuator movement to maintain the desired room conditions for various entering water temperatures. Actuator shall be complete with spring return- fail open configuration. Cooling capacity shall be regulated by varying the chilled water flow. The maximum differential pressure across the closed valve shall be 200 PSI.
 - b. Valve position feedback: Actuator shall be provided with auxiliary switch for valve position feedback.
 - 3. System Design Pressure
 - a. Standard Pressure: The chilled water circuit shall be designed for a maximum system pressure of 150PSI.
- E. FAN SECTION
- 1. Fan and Motor
 - a. The unit shall be equipped with one plug fan: integral direct driven fan with backward-curved blades and electronically commutated DC motors, commonly referred to as EC fan. The fan speed shall be variable and automatically regulated by the Liebert iCOM through all modes of operation. The fan shall have a dedicated motor, fault monitoring circuitry and speed controller, which shall provide a level of redundancy. The impeller shall be made of aluminum and dynamically balanced. The EC fan shall be located within the unit. The EC fan shall also provide greater energy savings than forward-curved centrifugal fans and variable speed drives.
 - 2. Air Flow Configuration
 - a. Downflow Supply with Top Air Return: The supply air shall exit from the front of the cabinet. The return air shall be through the top-mounted return extension collar. The fan shall be below the coil and pull air through the filters and cooling coil to ensure even air distribution and maximum coil performance.
- F. CABINET CONSTRUCTION AND ACCESSIBILITY
- 1. Cabinet Construction: The exterior panels shall be 20 gauge steel and powder-coated with black color paint to protect against corrosion. The exterior panels shall be insulated with 1/2" to 1", 1-1/2 lb. insulation. Front and side panels shall have captive, quarter-turn fasteners. The cabinet shall be designed so that all components are serviceable and removable using the front and right sides of the unit.
 - 2. Double-Skin Panels: The exterior panels shall be internally lined with 20 gauge galvanized steel, sandwiching the insulation between the panels for easy cleaning.

3. Units shall be configured for side utility connections (CHWS/R, A/C Cond, power, BAS, and Fire Alarm).

G. ELECTRICAL

1. The entire electrical system shall conform to National Electrical Code requirements. All wiring shall be neatly wrapped on run in conduit or cable trays and routed in bundles. Line voltage and 24 volt control circuit wiring shall be routed in separate bundles. Each wire shall end with a service loop and be securely fastened by an approved method. Each wire shall be numbered for ease of service tracing.
2. All electrically actuated components shall be easily accessible from the front of the unit without reaching over exposed high voltage components or rotating parts. Side access shall be provided where required, and clearly identified.
3. Each high voltage circuit shall be individually protected by circuit fuses. The blower motor shall fault monitoring circuitry and speed controller.
4. The electric box shall include all the contactors, starters, fuses, circuit breakers, terminal boards, etc., and shall allow for full service access without disrupting the airflow through the unit.

H. LOCKING DISCONNECT SWITCH

1. A locking-type, fused disconnect switch shall be mounted in the electrical panel and shall be capable of disrupting the flow of power to the unit. The locking type shall consist of a main unit switch operational from outside the unit. The electric panel compartment shall be accessible only with the switch in the Off position. The locking disconnect shall be lockable in support of lockout/tagout safety programs.

I. SHORT-CIRCUIT CURRENT RATING (SCCR)

1. The electrical panel shall provide at least 65,000A SCCR.

J. FILTRATION

1. MERV 11 Filters: The filter shall be an integral part of the system, located within the cabinet. The filter shall be deep-pleated, 2" thick with a MERV 11 rating efficiency based on ASHRAE 52.2-2007. A filter clog switch shall be included. Mesh type, cleanable filters shall be unacceptable.

K. MICROPROCESSOR CONTROL WITH GRAPHIC DISPLAY

1. Each CRAH unit controller shall be factory-set for continuous monitoring of supply air and control of the return air, fan speed and chilled water control valve position.
2. The unit controller shall allow precise monitoring and control of the IT equipment it is placed near. This control shall include predictive methods to control air flow and cooling capacity based on return air temperature and remote sensors. Proportional and Tunable PID shall also be user-selectable options. Internal unit component control shall include the following:
 - a. System Auto Restart: The auto restart feature shall automatically restart the system after a power failure.

- b. Sequential Load Activation: On initial startup or restart after power failure, each operational load shall be sequenced with a minimum of one second delay to minimize total inrush current.
- 3. The unit controller shall be complete with integrated sequencing to provide continuous monitoring of the room to optimize the control of multiple units in each room for maximum energy savings, without jeopardizing reliability. As a minimum, the controller shall be complete with the large face touchscreen iCOM Controller.
- 4. The Liebert iCOM shall be compatible with all Liebert remote monitoring and control devices. Options shall be available for BAS interface via Modbus, HTTP, BACnet and SNMP.
- 5. The control processor shall be microprocessor based with a 7" HD touch-screen graphical interface and be provided with Ethernet / RS-485 ports dedicated for BAS connectivity. The display and housing shall be viewable while the front panel is open or closed. The controls shall be menu driven. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus.
- 6. User Menus: The system shall display user menus for active alarms, event log, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date, and time), total run hours, and display options. The User Menus shall be defined as follows:
 - a. Active Alarms: Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
 - b. Event Log: Unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.
 - c. Unit View - Status Overview: Simple or Graphical Unit View summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
 - d. Total Run Hours: Menu shall display cumulative component operating hours for major components including fan motor.
- 7. Service Menus: In this mode, the controller shall display setpoints, diagnostic / service, alarm / event setup, economizer, BAS & teamwork setup, scheduler, options setup, auxiliary device setup, backup & security, and unit off. The Service Menus shall allow for custom configuration for each unit and shall be defined as follows:
 - a. Setpoints: Each unit shall be configured with adjustable settings for each of the following settings (refer to the drawings for setpoints):
 - 1) Temperature Setpoint (Return Air)
 - 2) Temperature Proportional Band
 - 3) Fan Temperature Setpoint
 - 4) Humidity Setpoint
 - 5) Humidity Sensitivity
 - 6) High Temperature Alarm

- 7) Low Temperature Alarm
- 8) High Humidity Alarm
- 9) Low Humidity Alarm
- b. Teamwork/Standby: Menu shall allow planned rotation or emergency rotation of operating and standby units; however, units are intended to operate in parallel (Teamwork Mode 1).
- c. Alarm Setup: Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available; however, units are intended to operate in parallel (Teamwork Mode 1).
 - 1) High Temperature
 - 2) Low Temperature
 - 3) High Humidity
 - 4) Low Humidity
 - 5) Main Fan Overload—Optional
 - 6) Change Filter
 - 7) Fan Failure
 - 8) Unit Off
 - 9) Audible Alarm: The audible alarm shall annunciate any alarm that is enabled by the operator.
 - 10) Common Alarm: A programmable common alarm shall be provided to interface user-selected alarms with a remote alarm device.
- d. Diagnostic Service (Sensor Calibration): Menu shall allow unit sensors to be calibrated with external sensors.
- e. Options Setup: Menu shall provide operation settings for the installed components.
- f. BAS & Teamwork Setup: Menu shall allow Unit-to-Unit (U2U) communication and setup for Teamwork Modes of operation (up to 32 units).
- g. Teamwork Modes of Operation: Saves energy by preventing operation of units in opposite modes multiple units.
- h. Diagnostics/Service Mode: The Liebert iCOM® shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. An LED on a circuit board will indicate each control output.

8. Advanced Menus, which include the factory settings and password menus, shall be defined as follows:
 - a. Factory Settings: Configuration settings shall be factory-set based on the pre-defined component operation.
 - b. Change Passwords: Menu shall allow passwords to be set or changed.

L. CONTROL METHODS AND OPTIONS

1. Controlling Sensor Options: Liebert iCOM shall be flexible in the sense that it allows for controlling the capacity and fan from multiple different sensor selections. The sensor selections shall be:
 - a. Cooling Capacity
 - b. Supply air temperature
 - c. Remote space temperature
 - d. Return air temperature
 - e. Fan Speed
2. Temperature Compensation: Liebert iCOM allows the ability to compensate the supply and return setpoints to maintain cooling OR return temperatures to meet cooling needs or Service Level Agreement (SLA) guidelines.
3. Dew Point Control: Liebert iCOM shall be able to control the humidity based on dew point to ensure accurate humidity control. This method will eliminate the need to dehumidify or humidify based on the air temperature when looking at moisture content.
4. Virtual Back-Draft Damper: Liebert iCOM allows for the use of a virtual back-draft damper - eliminating the need for a mechanical damper. This allows the EC fan to spin at a low speed (15%) to act as a damper.
5. Cascade: Liebert iCOM cascade option shall allow the units to turn On and Off based on heat load when in Teamwork Mode 1(as described above).

M. REQUIRED ACCESSORIES

1. Remote Stop/Start: In the event of power loss, unit shall have automatic restart capability, with user settable time delay on restart. Unit shall be provided with contacts for remote emergency power off.
2. Common Alarm Contact: The common alarm contacts shall provide the customer with a set of normally open contacts for remote indication of unit alarms.
3. Three remote alarm device contacts shall be provided for units with a condensate pump.
4. Low Voltage Terminal Package: Two extra N/O common alarm contacts shall be provided. Two extra remote shutdown terminals shall be provided. One pair of N/O contacts shall be factory-installed and wired to indicate Main Fan Overload. One pair of N/O contacts shall be provided for Liebert Liqui-tect® signal shut down.

5. Leak Detection: Provide a solid state zone-type leak detector with 20 foot cable. Install cable within the containment angle (field fabrication, refer to detail on drawings) in a serpentine manner to maximize the coverage. Leak detection shall be equal to Liebert Liqui-tect 460 Zone Leak Detection.
 - a. Liebert Liqui-tect 460 Zone Leak Detection: Provide one zone leak detection system per unit, complete with water sensor cables with no moving parts and hermetically sealed to keep out dust and dirt. The Liebert Liqui-tect 460 (LT460) shall provide a zone detection of leaks. The LT460 shall constantly monitor points for leaks, internal faults and power failures and warn of any abnormal conditions. LED's shall provide status indication and also ensure the cable is properly installed and operational under raised floors. The LT460 shall provide two independent outputs to provide a signal to a local alarm panel, Liebert environmental unit, remote building management system or external equipment.
 - b. Liebert Liqui-tect 460 Module: The LT460 shall consist of a metal enclosure with a hinged top door providing access to the internal circuit board for wiring termination and configuration of DIP switches. The LT460 shall monitor up to 100 feet of connected LT500Y leak detection cable.
 - c. LT500Y Leak Detection Cable: The cable material and construction shall allow the cable to lie flat when used with hold-down clips. The LT500Y shall be plenum-rated and UL-listed for safe operation. Provide cables 20 feet in length. The LT460 shall be rated for 24VAC, 50/60Hz and 0.12A.
 - d. Leak detection shall be programmed to provide an alarm only, and not shut down unit.
6. Provide unit with dual float condensate pump. The dual float condensate pump shall be complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The unit shall remain operational in the event a high water level alarm is triggered. The condensate pump shall be field-installed on downflow units.
7. Floor Stand: Downflow / Front Supply: The floor stand shall be constructed of galvanized steel. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be 6" high.
8. Return Plenum: Provide unit with a 24" return air plenum extension. Plenum shall be constructed of 20-gauge steel and power-coated with black color paint to protect against corrosion. The exterior panels are insulated with 1", 1-1/2 lb. insulation.

N. SPECIAL FEATURE ACCESSORIES

1. AHUs shall be provided with the following special construction features:
 - a. High density (3 pcf) neoprene coated fiberglass panel insulation with sound absorption qualities. [Equal to Liebert SFA #E-4493-19].
 - b. CHW valve actuator and auxiliary contact for valve position status indication using a motorized ball valve, rather than standard globe valve and actuator. Valves shall be spring return / fail open on loss of power. [Equal to Liebert SFA #E-205338-1].
 - c. Quick Start: Each unit shall be equipped with a quick-start feature that allows the unit to quickly recover from a loss of power.

2.3 HORIZONTAL CEILING MOUNTED COMPUTER ROOM AIR CONDITIONING UNITS

A. GENERAL

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:
2. Vertiv / Liebert
3. General: Provide units of factory assembled packaged unitary type
4. Capacities: Provide units of capacity and type as indicated on the drawings and schedules.
5. Components: Provide units that draw air through filter and coils, and that include fans, electric heating coils, cooling coils, filters, motors, starters, controls, and all other components necessary for proper operation.

B. Cabinet Construction:

1. The cabinet and chassis shall be constructed of heavy gauge galvanized steel and designed for easy installation and service access from front and bottom of unit only (water cooled units require end access). Mounting brackets shall be integral to the cabinet design. Internal cabinet insulation shall meet ASHRAE 62.1 requirements for Mold Growth, Humidity & Erosion, tested per UL 181 and ASTM 1338 standards.

C. Air Distribution:

1. The air distribution system shall be constructed with a quiet, direct-drive fan assembly equipped with double-inlet blower, self-aligning ball bearings and lifetime lubrication. Fan motor shall be permanent-split capacitor, high efficiency type, equipped with two speeds for air flow modulation. The microprocessor controller shall use the lower fan speed for precise dehumidification control. Fan speed shall also be user selectable from the wall controller.
2. System shall be suitable for supply and return air plenum or ducted supply and return air distribution.
3. Air filter shall be a 1" MERV 8 type.

D. Microprocessor Control

1. The control system shall be microprocessor-based, factory-wired into the system and tested prior to shipment. The wall-mounted controller shall include a 2-line by 16-character liquid crystal display (LCD) providing continuous display of operating status and alarm condition and shall be capable of displaying values in °F or °C.
2. An 8-key membrane keypad for setpoint/ program control, fan speed selection and unit On/Off shall be located below the display. Controller shall be password protected to prevent unauthorized set point adjustments.
3. Field-supplied 4-conductor thermostat wire shall be used to connect the wall-mounted controller to the unit control board. Temperature and humidity sensors shall be located in the wall box, which shall be capable of being located up to 300 ft (91.4m) from the evaporator unit when using a remote temperature/humidity sensor in the conditioned space.
4. Monitoring: The LCD shall provide On/Off indication, operating mode indication, fan speed indication and current day, time, temperature and humidity (if applicable) indication. The

monitoring system shall be capable of relaying unit operating parameters and alarms to the Vertiv™ Liebert® IS-Unity-DP or Vertiv™ Liebert® SiteScan™ monitoring systems.

E. Unit Controls:

1. Common Alarm and Remote On/Off: A common alarm relay shall provide a contact closure to a remote alarm device. Two (2) terminals shall also be provided for remote On/Off control. Individual alarms shall be “enabled” or “disabled” from reporting to the common alarm.
2. Setback Control: The control shall be user-configurable to use a manual setpoint control or a programmable, time-based setback control. The setback control will be based on a 5 day/2 day programmed weekly schedule with capability of accepting 2 events per program day.
3. Temperature Calibration: The control shall include the capabilities to calibrate the temperature and humidity sensors and adjust the sensor response delay time from 10 to 90 seconds. The control shall be capable of displaying temperature values in °F or °C.
4. System Auto Restart: For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the wall-mounted controller or from the central, site-monitoring system.

F. Factory Installed Sensors:

1. Filter Clog Switch: The filter clog switch senses pressure drop across the filters and shall annunciate the wall controller upon reaching the adjustable setpoint. The filter clog switch shall be factory installed in every cooling unit.
2. High-Temperature Sensor: The high-temperature sensor shall immediately shut down the system when high temperatures (125°F, 51.7°C) are detected. The high-temperature sensor shall be mounted with the sensing element in the return air of every cooling unit.

G. Unit Alarms: The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:

1. High Temperature
2. Low Temperature
3. High Humidity
4. Low Humidity
5. High Water Alarm - Lockout Unit Operation
6. Loss of Power
7. Custom Alarms (2x)
8. Filter Clog
9. Water Detected
10. Custom Alarms (2x): User-customized text can be entered for the two (2) custom alarms.

- H. Alarm Controls: Each alarm (unit and custom) shall be individually enabled or disabled (except for high water in condensate pan) and can be programmed for a time delay of 0 to 255 seconds of continuous alarm condition to be recognized as an alarm. Each alarm can also be enabled or disabled to activate the common alarm (except high water in condensate pan).
- I. Audible Alarm: The audible alarm shall annunciate at the wall-mounted controller any alarm that is enabled by the operator.
- J. Common Alarm: A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device. Alarms shall be enabled or disabled from reporting to the common alarm.
- K. Remote Monitoring: All alarms shall be communicated to the Liebert remote monitoring system with the following information: date and time of occurrence, unit number and present temperature and humidity.
- L. GLYCOL WATER SYSTEM COMPONENTS
 - 1. Glycol Water Control Valve: The control valve shall be a motorized, slow-close, spring-return type to reduce water hammer. Design working pressure shall be 300psi, with a maximum close-off pressure of 40psi.
 - 2. Glycol Water Coil: The cooling coil shall have a minimum of 2.4 sq.ft. face area, 2 rows deep. It shall be constructed of copper tubes and aluminum fins. The coil assembly shall be mounted in a condensate drain pan with internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the unit upon high water condition.
- M. FACTORY-INSTALLED OPTIONS
 - 1. Remote Monitoring and Control-IS-UNITY-DP: The IS-UNITY-DP BMS Monitoring Solution shall provide SNMP v1/v2c/v3, BACnet IP, BACnet MSTP, Modbus TCP/IP, and Modbus RTU monitoring capability to the unit. Card shall employ Ethernet and RS-485 networks to monitor and manage a wide range of operating parameters pertaining to the cooling system. The Unity card shall provide access to the unit remotely via a web interface and shall support Vertiv™ Liebert® Nform connectivity. The Vertiv™ Liebert® IS-UNITY-DP card shall be factory mounted inside an enclosure on the outside of the unit and shall be factory wired for power and unit communications. Ethernet cable providing network access to the world-wide web or to a BMS shall be field wired.
- N. SHIP-LOOSE ACCESSORIES
 - 1. Filter Box and Duct Kit: A return air filter box shall be provided with hinged filter access, and 3/4" duct flange. A 1" duct flange shall also be provided for air discharge. Filter shall be 4" x 16" x 20" MERV 8.
- O. ELECTRICAL
 - 1. The entire electrical system shall conform to National Electrical Code requirements. All wiring shall be neatly wrapped on run in conduit or cable trays and routed in bundles. Line voltage and 24 volt control circuit wiring shall be routed in separate bundles. Each wire shall end with a service loop and be securely fastened by an approved method. Each wire shall be numbered for ease of service tracing.
 - 2. All electrically actuated components shall be easily accessible from the front of the unit without reaching over exposed high voltage components or rotating parts. Side access shall be provided where required, and clearly identified.

3. The blower motor shall have thermal and short circuit protection.
4. The electric box shall include all the contactors, starters, fuses, circuit breakers, terminal boards, etc., and shall allow for full service access without disrupting the airflow through the unit.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver units with factory installed shipping skids and lifting lugs; pack components in factory fabricated protective containers.
- B. Handling: Handle units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units with new units.
- C. Storage: Store units in a clean, dry place and protect from weather and construction traffic.
- D. Unloading: Comply with manufacturer's rigging instructions for unloading air handling units, and moving them to final location.

3.2 FLOOR MOUNTED COMPUTER ROOM AIR CONDITIONING UNIT INSTALLATION

- A. General: Install air handling units where indicated on the drawings in accordance with equipment manufacturer's published installation Instructions.
- B. Provide containment curb around base of each unit.
- C. Access: Provide access space around air handling units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.
- D. Electrical Wiring: Install electrical devices furnished by manufacturer but specified to be factory mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.
- E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings.

3.3 HORIZONTAL CEILING MOUNT UNIT INSTALLATION

- A. General: Install fan coil units where indicated on the drawings in accordance with equipment manufacturer's published installation Instructions.
- B. Access: Provide access space around fan coil units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but specified to be factory mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.
- D. Piping Connections: Install piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings.

- E. Field-Supplied Drain Pan: A field-supplied pan with drain shall be installed beneath ducted cooling units.

3.4 START UP

- A. General: Start and adjust all units installed under this specification under the supervision of an authorized factory trained representative of the manufacturer of each unit. Perform operational checks to make certain that controls and safety devices and systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tests repeated. The performance of start-up tests shall not be considered as fulfilling part or all of the commissioning requirements as specified in "Commissioning Tests" article of this Section.
- B. An operational check shall be made to demonstrate compliance with contract requirements, including but not limited to, capacity and control accuracy.
- C. A report, signed by each factory representative, shall be submitted showing test conditions and results.

END OF SECTION 238123

SECTION 260100 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

- A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Electrical Divisions.
- B. The drawings and specifications shall be followed in layout of work.
- C. The Architectural drawings shall be used for all dimensional information. Do not scale from the Electrical drawings.
- D. Contract Document Interpretation/Discrepancies:
 - 1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.
 - 2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.
 - 3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.
 - 4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Information Technology, etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.
- E. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings, specifications, and addenda apply to this work.

1.2 DESCRIPTION

- A. Unless otherwise modified in other Sections, or on the contract drawings, which define the scope and arrangement of the electrical work to be provided, the applicable provisions of these General Requirements shall govern the furnishing of all supervision, labor, equipment, tools, services, and materials necessary to install a complete electrical system ready for continuous and successful operation. The work shall include, but not be limited to, the furnishing and installation of the following items, as applicable:
 - 1. Switchboards, power and lighting panelboards, and all required overcurrent devices.
 - 2. Power feeders, branch circuit wiring and disconnect switches for mechanical equipment.
 - 3. Motor starters, including those provided by Division 23.
 - 4. Lighting and receptacle feeders and branch circuit wiring.
 - 5. Lighting fixtures with lamps.

6. Exit and emergency lighting.
 7. Fire alarm system.
 8. Computer Management Information, Intercommunication, Sound, Video Cable, Master Antenna, Master Clock and Program, Security, Lightning Protection and Emergency Power Systems, including raceways, wiring and outlets, meeting the requirements of and coordination with the associated companies and the applicable sections of these specifications.
 9. As elsewhere indicated on the drawings or specifications.
- B. Provide seals for all openings through smoke and fire-rated walls, floors, or ceilings used as passage for electrical conduits, cables, and cable trays per the smoke and fire stopping requirements in this section. This applies to both new and existing penetrations.

1.3 PERMITS, INSPECTION AND CERTIFICATION

- A. Permits: Refer to the General Conditions of the Contract.
- B. Inspections:
1. Refer to the latest edition of the local power company manuals for service inspection requirements.
 2. See submittal requirements section of this specification section for additional work related to the inspection documentation needed for all underground work.
- C. Certifications:
1. Certificates of final inspection and approval required by agencies or authorities having jurisdiction shall cover all electrical work.
 2. All certificates of final inspection and approval shall be delivered to the Engineer prior to final acceptance of the electrical work.

1.4 CODES, STANDARDS AND REFERENCES

- A. The electrical work covered under the specifications and drawings shall be performed in strict accordance with the latest adopted edition of the following codes and standards:
1. National Electrical Code (NEC), NFPA 70
 2. Applicable codes and standards of the National Fire Protection Association (NFPA)
 3. National Electrical Safety Code, ANSI C2
 4. International Building Code (IBC)
 5. International Energy Conservation Code (IECC)
 6. American with Disabilities Act (ADA)
 7. All authorities having jurisdiction
 8. Motorola R56 Standards and Guidelines for Communication Sites
- B. The work covered under the specifications and drawings shall be performed using the following references as minimum standards for construction and testing:
1. American National Standard Institute (ANSI)
 2. National Electrical Manufacturers' Association (NEMA)
 3. Underwriter's Laboratories (UL)
 4. The Occupational Safety and Health Act (OSHA)
 5. InterNational Electrical Testing Association (NETA)
 6. Applicable standards of the utility company and the telephone company
 7. American Society of Testing Materials (ASTM)

8. Institute of Electrical and Electronic Engineers (IEEE)
9. Illuminating Engineering Society (IES)
10. Insulated Cable Engineers Association (ICEA)
11. Lightning Protection Institute (LPI)

- C. Electrical construction materials shall, where a listing is normal for the particular class of material, be listed in "Electrical Construction Material List" of the Underwriter's Laboratories, Inc. (UL) and shall bear the listing label. Electrical equipment shall, where a listing is normal for the particular class of equipment, be listed in the "Electrical Appliance and Utilization Equipment List" of the Underwriter's Laboratories, Inc. (UL) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by a Nationally Recognized Testing Laboratory (NRTL), inspection agency or approved organization shall be acceptable.

1.5 CLARIFICATION OF DRAWINGS

- A. Should a bidder find discrepancies in or omissions from the drawings or specifications, or should he be in doubt in regard to their intent, the Contractor shall notify the Engineer before submitting bid proposal. The Engineer shall then send written instructions to all bidders.

1.6 SUBMITTALS, REVIEW AND ACCEPTANCE

- A. Complete shop drawings and material lists shall be submitted by the Contractor for review by the Engineer in accordance with the requirements of the GENERAL PROVISIONS. Equipment and materials for which shop drawings are not submitted shall be provided as specified, and other manufacturers and products will not be allowed. No work shall be fabricated or ordered by the Contractor until approval has been given by the Engineer.
- B. Complete shop drawings showing dimensions, materials, arrangements, and other pertinent data shall be submitted.
- C. Complete lists of materials and equipment shall be submitted. Full description catalog or other data shall be submitted.
- D. Shop drawings and material lists shall be submitted for, but not limited to the following:
1. Conduit
 2. Wire
 3. Boxes, Fittings, and Wire Troughs
 4. Cabinets
 5. Wiring Devices
 6. Panelboards
 7. Dry-Type Transformers
 8. Safety Switches
 9. Low Voltage Fuses
 10. Enclosed Circuit Breakers
 11. Lighting Fixtures and Components
 12. Lighting Control Equipment
 13. Switchboards
 14. Metering Equipment
 15. Floor Boxes
 16. Motor Starters
 17. Remote Control Switches
 18. Automatic Transfer Switches

19. Emergency Lighting Equipment
 20. As elsewhere indicated on the drawings or in the specifications.
- E. Submittals shall include but not be limited to the following information: Size, type, functional characteristics, compliance with standards, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.
- F. Shop drawings shall include plans, elevations, sections, mounting details of component parts, point to point interconnection diagrams, elementary diagrams, single line diagrams, and any other drawings necessary to show the fabrication and connection of the complete item or system.
- G. Submit shop drawings and/or diagrams for all specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings or where the proposed installation differs from that shown on the contract drawings.
- H. Submittals shall include Riser Diagrams and Schematic Wiring Diagrams, complete conduit and wire requirements, outlet and junction box sizes and power requirements, for the following systems:
1. Grounding Systems
 2. Fire Alarm Systems
 3. As indicated elsewhere on the drawings or specifications.
- I. Submit 1/4" (6 mm) or 1/2" (13 mm) scale plans showing layout of equipment in electrical and communication equipment rooms and closets, elevator machine rooms, etc., indicating sizes of equipment, dimensions, clearances, etc. based on equipment being installed.
- J. Prepare and stamp each submittal in a form indicating that the documents have been contractor reviewed, are complete and are in compliance with the requirements of these contract drawings and specifications.
- K. In general, catalog cuts, specification sheets, descriptive data, etc., shall be acceptable for submittal of all equipment specified by standard catalog numbers, unless otherwise noted in the construction documents.
- L. Shop drawings shall be clearly legible; poor reproductions or reduced photographic copies that are not legible shall be rejected.
- M. Before submission of shop drawings the Contractor shall carefully check same for proper capacity, operating characteristics, physical arrangement accessories, etc., as specified or noted on drawings. If shop drawings are submitted and indicate little or no prior checking by the Contractor, they shall be rejected.
- N. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.
1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.
 2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.
- O. Submittal Identifications:
1. Place a permanent label or title block on each submittal for identification.
 2. Indicate name of firm or entity that prepared each submittal on label or title block.
 3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by A/E.

4. Include the following information on label for processing and recording action taken:
- a. Project name
 - b. Date
 - c. Name and address of A/E
 - d. Name and address of contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate specification section
 - j. Drawing number and detail references, as appropriate
 - k. Other necessary identification
 - l. Example: 262416-01-0
 - 1) 262416 references the spec section
 - 2) 01 indicates this is the first submittal from this spec section
 - 3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)
- P. Submittals not in compliance with the requirements of this section will be returned without review.
- Q. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The contractor will be responsible to confirm that the final product and installation will be in conformance with the contract documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The contractor must fulfill the terms of the contract.
- R. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish the named item, or equivalent, subject to acceptance. Suitability of only the named item has been verified. Where more than one item is named, only the first named item has been verified as suitable.
- S. Substituted items or items other than first named shall be equal or better in quality and performance and must be suitable for the available space, required arrangement, application and clearances. Submit any and all data necessary to determine the suitability of substituted items. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" sub-section of this specification section, as well as all other requirements indicated throughout the Division-26 specifications. All changes incurred as a result of a substitution shall be provided at no additional cost to the Owner.
- T. Substitutions will not be permitted for specific items of material or equipment where specifically noted.
- U. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:
1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.

2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual “C”, “D”, or “E” noted in the margin, as follows:
 - a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.
- V. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:
1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor’s review indicating compliance with the contract documents.
 2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
 3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
 4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
 5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
 6. Failure to comply with the above will result in the submittal being returned and marked “Not Reviewed”.
- W. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned “Not Acceptable” or “Revise and Resubmit”, the contractor shall choose one of the following courses of action:
1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design, or
 2. Reimburse the engineer for all additional review time required to achieve a submittal review from the engineer of “No Exceptions Taken.”
 3. Should the contractor choose option 2 above, the engineer shall be reimbursed at an hourly rate of \$175 per hour with payment due prior to the return of the final submittal. In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.
- X. Resubmittals: Resubmittals shall comply with paragraph 1.06 of this section and the following additional requirements.
1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual “C”, “D”, or “E” as follows:
 - a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.

- c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.7 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of electrical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible electrical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner’s Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic AutoCad or Revit format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad or Revit and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic AutoCad or Revit documents shall be up-loaded to the owner’s FTP site. The final AutoCad or Revit documents shall indicate in the title or revision block “RECORD DOCUMENTS” along with the date completed. The electronic format shall be compatible with the owner’s preferred version of AutoCad or Revit. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Electronic files (AutoCad or Revit) of mechanical, electrical and plumbing (MEP) drawings may be made available upon receipt of a signed copy of the Engineer’s Electronic Document Disclaimer (available upon request). The electronic files shall not be utilized for the preparation of coordination/installation/fabrication shop drawings. Coordination/installation/fabrication shop drawings shall be created independently from the electronic MEP files (i.e. AutoCad drawings and/or Revit model). Please note: the electronic MEP Revit model (where applicable) was created at a level of detail similar to BIM LOD 300; however, some MEP elements were modified to provide clarity and legibility to the two-dimensional construction documents. In addition, the electronic files may include delegated design elements that may differ as a result of the final delegated design to be completed by the Contractor (this may include all disciplines including architectural, structural, etc.). Modifications of the MEP systems to accommodate those delegated design elements shall be provided by the Contractor at no additional cost to the Owner.
- E. Should the Contractor’s electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.8 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Upon completion of all work, the Contractor shall thoroughly instruct the Owner's representatives in the proper operation and maintenance of all electrical equipment and systems. Instructions shall be done only after completed systems have been put into operation and tested for proper operation and performance. Instructions shall be given only by experts in the equipment or systems and shall include descriptions and demonstrations for procedures of operation, data record keeping, etc.

- B. The Contractor shall demonstrate, by actual usage, the proper operation of each and all portions of the various systems to the Owner or his appointed representative. Additional instructional periods shall be provided as required elsewhere in these specifications.
- C. Following completion of the Electrical Contract and prior to the instructional period and final acceptance of the contract, the Contractor shall prepare three (3) Operating and Maintenance Manuals describing the electrical systems and equipment. Data in the manuals shall include, but not be limited to, the following:
 - 1. Test results for all testing conducted in accordance with Division-26 Section, "Inspections, Testing and Start-up".
 - 2. List of materials and equipment with name and address of vendor.
 - 3. List of lamps, fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size or ordering description with name and address of vendor.
 - 4. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
 - 5. A certificate of approval from the Electrical Inspector.
 - 6. A final copy of the approved coordination study.
 - 7. Final copies of shop drawings and submittals.
 - 8. Manufacturer's guarantees and warranties.
- D. Manuals shall be of the loose leaf type, in heavy duty binders, with a master index and dividers with plastic tabs indicating system and equipment described.

1.9 RISER PLAQUE

- A. Provide a computer generated riser diagram, 24" x 36" (600 mm x 900 mm) (nominal), of the completed distribution system showing incoming services, switchboard, feeders, transformers, panelboards and related equipment. All feeders and circuits shall be sized and all equipment identified. Drawing shall be framed with plexiglass overlay.

1.10 GUARANTEE

- A. Guarantee obligations shall be as hereinbefore specified in the GENERAL PROVISIONS of these specifications, except as follows:
 - 1. Guarantee the complete electrical system free from all mechanical and electrical defects for a period of two (2) years beginning from the day of final acceptance of the work or beneficial occupancy by the Owner, whichever occurs first.
 - 2. During the guarantee period, the Contractor shall be responsible for the proper adjustments of all systems, equipment and apparatus installed by him and do work necessary to insure efficient and proper functioning of the systems and equipment.
 - 3. Upon receipt of notice from the Owner of failure of any part of the electrical installation during the guarantee period, new replacement parts shall be furnished and installed promptly at no cost.
 - 4. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

1.11 DEFINITIONS

- A. The following definitions apply to firestopping:
 - 1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

- A. All materials and equipment shall be new, the best of their respective kinds and suitable for the conditions and duties imposed on them. Replacement parts shall be available. A permanent service organization maintained or trained by the manufacturer shall be available for service.
- B. The Contractor shall set-in place and connect all electrical equipment furnished under Division-26 and all other Divisions of the Contract.
- C. Verify exact electrical service requirements for each piece of equipment receiving electrical connections. Provide proper service for each.
- D. Include any and all items required by the National Electrical Code and field conditions for the proper connection and installation of each piece of equipment.
- E. Products of one manufacturer shall be used where two or more items of the same kind are required.

2.2 EQUIPMENT DEVIATIONS

- A. The Contractor shall be governed by the requirements of the GENERAL PROVISIONS of these specifications. After an item has been approved, no substitution will be permitted except where such substitution is considered by the Engineer to be in the best interest of the Owner.
- B. The Contractor shall notify the Engineer of any changes in electrical characteristics of equipment being installed as opposed to that specified.
- C. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, ductwork, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings, and detailing required shall, with the approval of the Engineer, be prepared by the Contractor at the Contractor's own expense.
- D. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, with the approval of the Engineer, the Contractor shall furnish and install such ductwork, piping, structural supports, insulation, controllers,

motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.3 FIRESTOPPING

- A. All penetrations through fire barriers shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.
- B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, ducts, cable trays, conduit, and cables. \
- C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.
- D. Acceptable products shall be limited to Johns Manville "Firetemp-C1;" Hilti "FS-One;" or 3M "CP25WB+." Coordinate with General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 SMOKE STOPPING

- A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.
- B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.03 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

PART 3 - EXECUTION

3.1 SUPERVISION AND COORDINATION

- A. The Contractor shall have competent supervision on the site at all times to layout, check, coordinate and supervise the installation of all electrical work and be responsible for the accuracy thereof. He shall plan the installation of all electrical work, giving consideration to the work of other trades, to prevent interference.
- B. Determine the location, size, etc. of all chases, sleeve openings, etc. required for the proper installation of the electrical work and see that such are provided. All chases, sleeves, openings, etc. shall be set prior to erection of new work to prevent delay in the progress of other work or trades.
- C. Conditions and/or situations which prevent the proper installation of any equipment or item where shown on the drawings shall be called to the attention of the Engineer for instructions.
- D. Equipment shall be shipped or fabricated in sections of suitable size for entering the building and being removed from the finished building in the future if necessary.

- E. Fully investigate all peculiarities and space limitations for all materials and equipment.
- F. Outlet, pull and junction boxes and appliances which require operation, examination, adjustment, servicing or maintenance shall be readily accessible.
- G. Take all field measurements necessary for this work and assume responsibility for their accuracy.
- H. Coordinate the electrical work with all sub-contractors. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of electrical equipment. All electrical work shall be installed in proper sequence with other trades without any unnecessary delay.
- I. Make all sub-contractors, suppliers and manufacturers fully aware of all requirements of the Contract.
- J. Coordinate the spacing and arrangement of lighting fixtures, diffusers, grilles and access panels in ceilings to establish a symmetrical pattern. Unless otherwise indicated, items in modular ceiling systems shall be centered in individual tiles.
- K. Coordinate the rough-in of all electrical work performed under other Divisions of these specifications.
- L. Drawings indicate the approximate locations of outlets, apparatus and equipment. The runs of feeders and branch circuits as shown are schematic. Final routing is governed by structural conditions and other obstructions. This does not mean that the design may be changed; it merely refers to the exact run of a raceway between given points.
- M. The drawings are diagrammatic and indicate the general arrangement of the equipment, the runs of conduit and the manner of connection.
- N. The architectural, structural, mechanical, as well as the electrical drawings, shall be consulted in order to be entirely familiar with conditions to be encountered and special details.
- O. The Contractor shall be solely responsible for the proper arrangement of conduit.
- P. The Engineer shall make all final decisions as to any conditions which require the changing of any work.

3.2 STORAGE AND PROTECTION OF EQUIPMENT AND WORK

- A. All materials and equipment shall be properly and effectively protected by the Contractor during the execution of the work.
- B. All electrical equipment to be used in the construction shall be properly stored and protected against the elements. All equipment shall be stored under cover, and shall not be stored at the construction site on the ground, in mud, water, snow, rain, sleet or dust. Large diameter cables may be stored on reels outside, however, all cable ends shall be waterproofed and the reels covered with weatherproof materials. Such weatherproof materials shall be heavy-duty, securely fastened and made impervious to the elements.
- C. Conventional electrical construction materials such as building wire, outlet and junction boxes, wiring devices, conduit, lighting fixtures, fittings, etc., shall be stored in construction buildings, covered trailers or portable covered warehouses. Any equipment subject to damage or corrosion from excessive moisture shall be stored in dry, heated areas. Any equipment containing plastic or material subject to damage caused by excessive heat or sunlight shall be stored to prevent such damage. This includes plastic ducts and lenses.
- D. All gear and equipment, if delivered to the construction site before the building is under cover and the equipment site prepared shall be warehoused and protected. All gear and equipment shall be covered and

protected from the elements and other damage and shall be stored in a clean, dry, heated atmosphere, under cover at the Contractor's expense.

- E. All gear and equipment delivered to the construction site after the building is under cover shall be protected as described above and in addition shall be provided with auxiliary heat to prevent condensation damage. The gear shall also be protected against damage caused by carelessness of workmen who are installing equipment connected to or adjacent to the above electrical equipment.
- F. Equipment damaged as a result of the above conditions shall be properly repaired at the Contractor's expense or shall be replaced at the Contractor's expense, if, in the opinion of the Engineer the equipment has been damaged to such an extent it cannot operate properly after repairs are made.
- G. All electrical enclosures exposed to construction damages such as paint spots, spackling or plaster spatter, grout splashes, waterproofing compound, tar spots or runs and pipe covering compound splashes, shall be completely covered and protected against damage.
- H. In the event leakage into the building of any foreign material or fluid occurs or may occur, the Contractor shall take all steps as described above to protect any and all equipment.
- I. After connections to electrical equipment are complete and the equipment is ready for operation, all construction debris shall be removed from all enclosures. Such debris includes dust, dirt, wire clippings, tape and insulation removed in order to make connections.

3.3 CUTTING AND PATCHING

- A. All cutting of walls, floors, roofs, ceilings and/or partitions for the passage of conduit, etc., and closing up of superfluous openings around them in connection with the work under this contract, including the removal of all debris caused thereby, shall be performed by the Contractor.
- B. All cutting, patching and finishing shall be performed in accordance with the requirements of the respective division of the specification and shall conform to adjacent work, subject to the approval of the Engineer.
- C. Any work already in place that has been disturbed in the execution of the work shall be repaired and restored in harmony with the surrounding work.
- D. Do not cut structural members without approval of the Engineer.
- E. Patching shall be uniform in appearance and shall match with the surrounding surface.

3.4 PENETRATION OF WATERPROOF AND FIREPROOF CONSTRUCTION

- A. Coordinate the work to minimize penetration of waterproof construction including roofs, exterior walls and interior waterproof construction. Where such penetrations are necessary, provide all necessary curbs, sleeves, shields, flashings, pitch pockets, fittings and caulking to make the penetrations absolutely watertight.
- B. Where waterproofing or fireproofing have been removed or damaged in the execution of the work, the Contractor shall have such damage repaired by the respective trades working on the project.
- C. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
- D. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

- E. Slots, sleeves and other penetrations in floors, wall or other general construction shall be closed and sealed with an approved firestopping material.
- F. Floor slots and openings shall be closed with 16 gauge (1.6 mm) galvanized steel sheet supported on 1-inch by 1-inch by 1/8-inch (25 mm by 25 mm by 3 mm) structural angle drilled or supported with powder-driven studs into the building structure. Firestop with a layer of firestopping material not less than 1-inch (25 mm) thick which completely fills the opening. The top surface of the firestopping material shall be approximately 1-inch (25 mm) below the finished floor slab.
- G. Openings in walls shall be closed with 16 gauge (1.6 mm) galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/2-inch (13 mm) thick layer of non-sagging firestopping material to fully cover the opening.
- H. Single or multiple pipes passing through walls and floors shall have the annulus space between pipes or between pipes and structure filled with firestopping material to provide a fire rating equal to the rating of the floors and walls being penetrated. The annulus between exposed conduit and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.
- I. In fire-rated partitions where horizontal separation of opposite-facing electrical boxes is less than 24 inches, provide UL listed firestop around electrical boxes as required to maintain fire rating of wall.

3.5 MANNER OF INSTALLATION

- A. Provide equipment supports consisting of structural racks, hangers, rods, etc.
- B. Equipment supports shall be designed and constructed to safely support and distribute loads evenly over building areas, and withstand stresses to which they may be subjected.
- C. Coordinate the location and installation of supports and sleeves to be set in concrete.
- D. Provide finish metal access doors and frames as indicated or required for access to concealed electrical equipment requiring inspection, adjustment, maintenance, manual operation, etc., or required by code.
- E. In suspended metal pan, lay-in-panel, and accessible tile ceilings, the ceiling element may be used as the access panel.
- F. Access doors in 1-1/2 hour fire-rated construction shall bear the Underwriter's Laboratories "B" label.
- G. Floor-mounted equipment (switchboards, generators, transformers, sub-stations, motor control centers, starters, control cabinets, etc.) shall be provided with concrete foundations.
- H. Concrete foundations shall be reinforced to suit the loads placed on them and shall be in strict accordance with the equipment manufacturer's recommendations. Concrete materials and methods shall be as specified in Division-3 of these specifications. The Contractor shall refer to this Division to determine specific requirements.
- I. Unless otherwise indicated or required, concrete foundations shall extend 4-inches (100 mm) above the finished floor, at least 3-inches (75 mm) beyond the equipment base in all directions, shall have the top edges chamfered 1" (25 mm) and shall have the same surface finish as the adjacent and surrounding floor. Where equipment weight is such that the floor slab will support the equipment the concrete foundations shall be securely anchored to the floor slab with steel dowels. Properly prepare existing floors: remove paint or dirt, clean and scarify as necessary.

- J. The Contractor shall furnish and set, with proper templates, all anchor bolts and inserts required for the proper attachment of his equipment to the concrete foundations. Anchor bolts shall be of the size and number required by the equipment and/or recommended by the equipment manufacturer and shall be in accordance with the requirements detailed on the drawings and/or specified herein. Anchor bolts shall also be compatible where applicable, with vibration isolation requirements specified for the equipment. Anchor bolts shall be of adequate size and shall engage a steel plate of adequate dimensions cast into the slab.
- K. The drawings indicate the wiring method. The number of current carrying conductors per raceway or cable shall be as indicated. The number of current carrying conductors cannot exceed three (3) per raceway or cable, unless the ampacity adjustment factors of NEC Article 310 are applied.
- L. Each new and existing electrical penetration through a smoke and fire-rated wall, ceiling, or floor shall be sealed with an approved smoke and fire stopping method coordinated with the rating of the associated wall, ceiling, or floor construction.

3.6 CLEANING AND PAINTING

- A. All equipment and conduit shall be thoroughly cleaned of all cutting waste from reaming and tapping. All burrs and other foreign matter shall be removed. Should any part of the system be stopped up by such refuse after the various equipment and apparatus have been accepted, the Contractor shall be required to pay for all labor and materials required to locate and remove the obstruction, and replace and repair all work in any way disturbed thereby. All enclosures, etc., shall be cleaned of all rubbish, plaster, and other debris at the completion of the work.
- B. Paint all exposed metal surfaces, except for galvanized surfaces and extruded aluminum cable and wire duct, of all electrical equipment in mechanical rooms and equipment spaces. Paint all backboards in all telephone and electrical rooms.
- C. Do not paint nameplates or other elements where such application would interfere with operation or maintenance of equipment.
- D. All scratches or marred areas on factory painted equipment shall be touched up to match finish.

3.7 IDENTIFICATION

- A. Equipment (disconnects, panelboards, starters, relays, switches with pilot lights, pushbutton stations, etc.) shall be identified as to its function, equipment, or area served, etc. In finished areas and mechanical rooms and equipment spaces identification shall be engraved phenolic plates with approximate 3/16" (5 mm) high black letters on white background. Equipment connected to the emergency power system shall be provided with phenolic plates utilizing white letters on red background. Plates shall be attached to front of devices with stainless steel, oval head, machine screws. Panelboards and equipment cabinets shall also be identified with stenciled letters, 3/4" (19 mm) high, on inside of cabinet door, colored to contrast with background.
- B. All conduits containing electrical feeders shall be identified with vinyl cloth pipe markers by W.H. Brady or Seton. Labels shall be applied whenever a conduit enters or leaves a switchboard, panelboard, or a junction or pull box, and at each side of penetrations of walls or floors. Provide individual numbers and letters to indicate feeder number and voltage.
- C. All pull box and junction box covers shall be stenciled to indicate voltage, service and/or system. All stenciling shall be clear and legible from a distance of five (5) feet.
- D. No embossed plastic tape markers will be permitted for use in marking equipment.

- E. All underground feeders, branch circuits, ductbanks, etc. shall be identified with a continuous plastic tape equal to Allen Marking Tape. Tape shall be six inches wide, waterproof, chemically resistant, yellow marked "Caution - Buried Electrical Line Below". Tape shall be located approximately midway from grade to top of feeder.
- F. Receptacle Cover Plates: Provide label on front of cover plate unless otherwise noted. Label shall indicate source panel and circuit number. Label shall be a laminated, adhesive backed, peel-off, polyester type label. Label shall be comprised of a polyester base/substrate and a clear polyester top layer/laminate. The label ink shall be printed underneath the clear polyester laminate. Label shall have black lettering on clear background. Label width shall be a nominal 0.47" (12 mm) wide. Basis of design is the TZe labeling tape by Brother Mobile Solutions, Inc. For use with the Brother P-Touch EDGE Series labeling tools.
 - 1. For outdoor receptacles, label on front cover shall be the phenolic type, 1/16" thick.
- G. All identification shall be subject to the approval of the Engineer.

3.8 EXAMINATION OF SITE

- A. The Contractor shall examine the premises prior to submitting his bid and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made for any work in connection with any error or negligence on the Contractor's part. No claim for extra compensation will be recognized for difficulties encountered which, in the opinion of the Owner, would have been revealed by proper examination.

3.9 ELECTRICAL DEMOLITION

- A. All demolition of existing electrical equipment, conduit, wiring devices, lighting fixtures, etc. shall be performed under this section of the specification. The areas of demolition are defined on the architectural drawings and specific references are made on the electrical drawings.
- B. The electrical demolition in the renovation areas indicated on the drawings shall be complete and include all electrical work in the area unless noted otherwise.
- C. Existing electrical systems passing through areas of demolition to serve equipment beyond the demolition areas shall remain in service, or be suitably relocated and restored to normal operation, throughout the demolition and reconstruction of the area. The Contractor shall investigate and identify such equipment prior to demolition.
- D. Provide temporary electrical service to equipment disturbed by the demolition until such time as the permanent service can be restored.
- E. Where conduit and wiring to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source switchboard, panelboard or pullbox to the destination connection point. Provide new wiring of equal capacity.
- F. Exposed conduit and conduit within accessible ceilings, floors and walls to be demolished shall be removed in its entirety, including all conduit, supports, junction boxes, etc. Conduit concealed within non-accessible ceilings, floors and walls abandoned in place, shall be cut flush with walls and floors, plugged, and the adjacent surface patched to match existing.
- G. Wiring to be demolished shall be removed from both concealed and exposed conduit. No wiring which becomes unused as a result of the Contract shall be abandoned in place.

- H. Equipment specified or indicated to be demolished, shall be removed from the project site and shall not be reused. Equipment required to be temporarily disconnected and relocated shall be carefully removed, stored, cleaned, reinstalled, reconnected and made operational.
- I. All material being disposed of shall be done as required to meet the applicable environmental regulations for all local, state, and federal agencies. Examples include, but are not limited to, light fixture ballasts, fluorescent lamps, and batteries.
- J. Any outages in systems shall be coordinated with the Owner. Where duration of proposed outage cannot be tolerated by the Owner, provide temporary connections as required to maintain service.
- K. Disconnect abandoned outlets and remove devices and wiring back to point of use. Provide blank cover for abandoned outlets.
- L. The contractor shall use care when performing selective building and site demolition. The contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.
- M. Repair adjacent construction and finishes damaged during demolition. Patch all holes left from demolished equipment. Paint surfaces exposed by demolition to match adjacent surfaces.

3.10 CONNECTIONS TO EXISTING WORK

- A. When the work specified hereafter connects to any existing equipment, conduit, wiring, etc., the Contractor shall perform all necessary alterations, cutting, fitting, etc., of the existing work as may be necessary or required to make satisfactory connections between the new and existing work and shall leave the completed work in a finished and workmanlike condition, to the satisfaction of the Engineer.
- B. When the work specified hereafter or under other Sections or Divisions of the contract necessitates relocation of existing equipment, conduit, wiring, etc., the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike manner to the satisfaction of the Engineer.
- C. The Contractor is cautioned that all existing electrical systems and life safety systems must remain in service during all phases of construction.
- D. The Contractor shall work in close cooperation with the Owner for any temporary outages.
- E. It is imperative that all interruptions of the electrical service and standby service be kept to an absolute minimum. The Contractor must submit a written request to the Owner for any and all interruptions of the electrical service or the standby service 72 hours in advance of the planned outage.

3.11 WORKMANSHIP

- A. All materials and equipment shall be installed and completed in a first class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat or workmanlike appearance shall be removed and replaced when so directed

by the Engineer. The removal and replacement of this work shall be done, when directed in writing by the Engineer, at the Contractor's expense.

3.12 REPAIR OF EXISTING PROPERTY

- A. All work shall be carefully laid out in advance, and where cutting, channeling, chasing, trenching, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of raceways, outlet boxes, or other electrical work, this work shall be carefully done, and any damage to building, piping, equipment, or ground shall be properly repaired by skilled mechanics of the trades involved, at no additional cost to the Owner.

3.13 TEMPORARY ELECTRICAL SERVICE

- A. The Contractor shall provide temporary electrical service on the site as is necessary to enable his work and the work of others on the job to proceed and to test the operation of all apparatus, devices, systems which require electrical energy.
- B. The Contractor is responsible for temporary power as may be required for construction or as may be required to maintain critical operations during changeover of feeders or services. The Contractor is responsible for providing all equipment, making all arrangements (including all work needed to submit a service application to the power company), and making all connections required for temporary power.
- C. The Contractor shall disconnect and remove all equipment and facilities required for temporary power at the completion of the project.

3.14 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

- 1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
- 2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
- 3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

- 1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
- 2. A copy of the sign-off shall be provided to the Engineer for their record.
- 3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
- 4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:
 - a. Above ceiling
 - b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
 - c. Equipment rooms

END OF SECTION 260100

SECTION 260200 - PROJECT CLOSEOUT ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This section provides a summary of the primary electrical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:
 - 1. Testing
 - 2. Start-up
 - 3. Punch-out Procedures
 - 4. Operation and Maintenance Manuals (O & M Manuals)
 - 5. Demonstration and Training
 - 6. Record Documents
 - 7. Close-out Documents
- B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 TESTING

- A. The Contractor shall perform systems and equipment inspections and tests as specified in each Division-28 and Division-26 specifications section. Particular attention shall be paid to Division-26 section "Inspections, Testing and Start-up."
- B. An independent testing firm shall perform systems and equipment inspections and tests as specified in each Division-26 section. Particular attention shall be paid to Division-26 section "Inspections, Testing and Start-up."

3.2 START-UP

- A. The Contractor shall perform start-up on each piece of electrical equipment as specified in each section of Division-26.
- B. Where indicated in each section of Division-26, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.
- C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
2. A copy of the sign-off shall be provided to the Engineer for their record.
3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:
 - a. Above ceiling
 - b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
 - c. Equipment rooms

C. Upon completion of any and all punch lists (i.e. above ceiling, final, partial, phased, factory review, or specific item) the contractor shall provide an item by item sign-off indicating the date and who completed the item. The sign-off shall be submitted to the A/E and owner before final payment is processed. Should the contractor disagree with any item, they shall provide a written exception giving reason for review.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals in three-ring binders with each section separated by tab dividers. Include protective plastic sleeves for any software or folded large documents submitted.

B. At a minimum, the manual shall contain the following:

1. Test results for all testing conducted in accordance with Division-26 Section, "Inspections, Testing and Start-up".
2. List of materials and equipment with name and address of vendor.
3. List of lamps, fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size or ordering description with name and address of vendor.
4. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
5. A certificate of approval from the Electrical Inspector.
6. A final copy of the approved coordination study.
7. Final copies of shop drawings and submittals.
8. Manufacturer's guarantees and warranties.
9. A full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

- C. The O & M manuals shall be submitted to the A/E for review of general conformance.

3.5 DEMONSTRATION AND TRAINING

- A. Upon completion of work, instruct the owner's representative in the proper operation and maintenance of each electrical system in accordance with applicable specification sections.
- B. Instructions shall be given by persons expert in the operation and maintenance of each system / equipment.
- C. Prepare statement(s) for signing by Owner's representative indicating the date of completion of instructions and hours expended. Furnish copies of signed statements to the A/E.
- D. Final demonstration of all electrical equipment shall be recorded in DVD compatible format. Provide DVD's to the Owner.

3.6 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of electrical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible electrical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Computer (CADD) files of electrical drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.
- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

3.7 CLOSEOUT DOCUMENTS

- A. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:
1. Final punch lists indicating completion of all items.
 2. All record drawings.
 3. All record specifications.
 4. Operation and Maintenance Manuals.
 5. Complete final cleaning.
 6. Remove temporary facilities and complete site restoration.

END OF SECTION 260200

SECTION 260501 - INSPECTIONS, TESTING AND START-UP

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The intent of the inspection, testing, and check-out work specified herein is to ensure that all electrical workmanship and equipment, whether Owner furnished or Contractor furnished, is installed and performs in accordance with the Contract Documents, manufacturer's instructions and all applicable codes and requirements. Also, it is intended to ensure the following:
 - 1. Equipment has not been subjected to damage during shipment or installation.
 - 2. Equipment is in accordance with the specifications.
 - 3. A bench mark is established for routine maintenance and troubleshooting.
 - 4. Successful start-up without last minute interruptions and delays.
 - 5. Each system component is installed satisfactorily and will perform its function reliably throughout its life and the life of the overall system.
- B. Testing requirements in other sections of this Specification are intended to compliment and not supersede nor be superseded by this Section.

1.2 RELATED SECTIONS

- A. Division-01 Section - Submittals.
- B. Division-01 Section - Quality Control.
- C. Division-01 Section - Materials and Equipment.
- D. Division-26 - Electrical Specifications.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI C2, National Electrical Safety Code
 - 2. ANSI Z244-1, American National Standard for Personnel Protection
- B. American Society of Testing and Materials (ASTM)
- C. Institute of Electrical and Electronic Engineers (IEEE)
- D. Insulated Cable Engineers Association (ICEA)
- E. International Electrical Testing Association (NETA)
- F. National Electrical Manufacturer's Association (NEMA)
- G. National Fire Protection Association (NFPA)
 - 1. ANSI/NFPA 70, National Electrical Code

2. ANSI/NFPA 70B, Electrical Equipment Maintenance
3. ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces
4. ANSI/NFPA 780, Lightning Protection Code

H. Occupational Safety and Health Administration (OSHA)

I. State and Local Codes and Ordinances

1.4 SUBMITTALS

- A. Provide resumes for personnel conducting tests and evidence of the testing firm's qualifications, accreditation and experience.
- B. Provide a list of test equipment to be utilized including the manufacturer's name, model number, serial number, accuracy, and last date of calibration.
- C. Provide industry standards or guide specifications used in lieu of National Standards.
- D. Provide testing procedures and schedules.

1.5 TESTING FIRM

- A. When an independent testing firm is utilized, the following shall apply. The testing firm shall be a competent, independent electrical equipment testing laboratory or organization. The testing firm shall not be a subsidiary, division, nor department of either the installing Contractor or the manufacturer of the equipment materials or systems being inspected and tested. The testing firm shall be a fully accredited member of the International Electrical Testing Association (NETA) and have the specialized experience and skill in the supervision and performance of all inspection and testing specified herein.

1.6 TEST INSTRUMENT CALIBRATION

- A. The testing firm or contractor shall have a calibration program which assures that all applicable test instrumentation is maintained within rated accuracy.
- B. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- C. Instruments shall be calibrated in accordance with the following frequency schedule:
 1. Field instruments, analog: six (6) months.
 2. Field instruments, digital: twelve (12) months.
 3. Laboratory instruments: twelve (12) months.
 4. Leased specialty equipment: twelve (12) months.
- D. Calibration labels shall be visible on all equipment and shall have a date of calibration and due date. Calibration records shall be available for review by the Owner.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 COORDINATION

- A. Provide all necessary supervision and labor, materials, tools, test instruments and other equipment or services required to inspect, test, adjust, set, calibrate, functionally and operationally check all work and equipment.
- B. When an independent testing firm is utilized, provide a set of contract documents to the testing firm.
- C. When an independent testing firm is utilized, provide a copy of the approved short-circuit and protective device coordination study to the testing firm.
- D. Provide the testing firm a set of approved submittals and shop drawings for the equipment to be tested by the testing firm.
- E. Prepare procedures and schedules for all inspections, tests, settings and calibrations specified or otherwise required. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks. All procedures submitted shall include proposed job safety rules.
- F. Provide a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements. The Owner shall approve all sources of electrical power for testing.
- G. Notify the Owner prior to the commencement of any testing.

3.2 INSPECTIONS AND TESTS

- A. Equipment purchased by the Contractor or purchased by the Owner but installed by the Contractor shall be inspected and tested to determine its condition.
- B. The inspections, tests and checks described herein shall not be considered as complete and all inclusive. Additional normal standard construction (and sometimes repetitive) checks and tests shall be provided as necessary throughout the project, prior to final acceptance by the Owner.
- C. At any stage of construction and when observed, any electrical equipment or system determined to be damaged, faulty, or requiring repairs shall be reported to the Owner. Corrective action may require prior approval.
- D. Perform routine insulation resistance, continuity and phase rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.
- E. At the option of the Contractor, either an independent testing firm or the Contractor shall provide testing of the following systems and equipment.
 - 1. 480 volt switchgear and switchboards
 - 2. Dry type transformers
 - 3. Grounding systems
 - 4. 480 volt circuit breakers rated 400 amperes and greater
 - 5. Instrument transformers
 - 6. Metering and instrumentation

- F. At the option of the Contractor, either an independent testing firm or the Contractor shall provide visual and mechanical inspections of the following systems and equipment.
1. Panelboards
 2. Dry type distribution transformers (600 volt and below)
 3. Low voltage wiring (600 volt and below)
 4. Molded case circuit breakers rated less than 400 amperes
 5. Automatic transfer switches
 6. Motor control
 7. Air switches (600 volt and below)
 - 8.
 9. Fire detection and alarm system
- G. All circuit breakers and protective devices shall be set and tested at the settings specified in the approved protective device coordination study. All fuses shall be selected and installed in accordance with the approved coordination study.
- H. All circuit breakers and protective devices shall be set as recommended by the manufacturer and tested at those settings. All fuses shall be selected and installed in accordance with the manufacturer's recommendations.
- I. The rotation of all motors shall be checked and corrective action shall be taken where necessary to obtain correct rotation.
- J. Engagement of an independent testing firm in no way relieves the Contractor of the responsibility for the performance of the many and varied tests, checkouts, and inspections required during the various stages of construction.
- K. In addition to other requirements, provide functional commissioning testing on all new equipment and systems shown on drawings E4.01, E4.02, E7.02, E7.03, E7.04, and E7.05.
- L. In addition to other requirements, provide functional commissioning testing to confirm sequence of operation for the Standby Generator Sequence of Operation shown on drawing E9.04.

3.3 CERTIFICATION

- A. Provide certified test reports. Test reports shall meet the criteria of a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA. The certification shall attest to the fact that the electrical installation has been installed and tested in accordance with the applicable National Standards or, where no National Standard exists, the applicable industry standard or guide specification for the equipment involved.
- B. The following information shall be included in the test reports.
1. Description of equipment tested (manufacturer, model number, serial number).
 2. Description of test and standards used.
 3. Description of test equipment.
 4. Test results with pass/fail criteria.
 5. Conclusions and recommendations.
 6. Names of personnel conducting the test.
- C. When testing is provided by an independent firm, the report shall be signed by a Registered Professional Engineer.

- D. Provide three (3) copies of the complete test report no later than thirty (30) days following completion of the tests.

END OF SECTION 260501

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SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. The Contractor shall provide, install and terminate all wires and cables for power, lighting, signal, control and related systems rated 600 volts and less.

1.3 SUBMITTALS

- A. Submit product data for electrical wires, cables and connectors.

1.4 QUALITY ASSURANCE

- A. All wires, cables and connectors and the installation of wires, cables and connectors shall comply with the following standards:
 - 1. NFPA 70 "National Electrical Code."
 - 2. UL Standards pertaining to wires and cables:
 - a. UL Std 44, Rubber Insulated Wires and Cables
 - b. UL Std 83, Thermoplastic - Insulated Wires and Cables
 - c. UL Std 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors, UL Std 486B for Use with Copper or Aluminum
 - d. UL Std 854, Service Entrance Cable
 - 3. Applicable NEMA Standards pertaining to wires and cables.
 - 4. Applicable IEEE Standards pertaining to wires and cables.
- B. Wires, cables and connectors shall be listed and labeled by UL.

PART 2 - PRODUCTS

2.1 WIRES AND CABLES

- A. All wiring #14 and larger shall be soft drawn copper, 98 percent conductivity, 600 volt insulation, type THHN/THWN.
- B. All wiring connections to lighting fixtures shall have insulation suitable for the temperatures to be encountered in accordance with the NEC.
- C. All wiring #8 and larger for feeders and branch circuits shall be stranded.

- D. Minimum wire sizes shall be #12 for power and lighting circuits and #14 for control circuits unless otherwise noted.
- F. All wiring shall have identification markings along the outer covering denoting conductor size, type of insulation, and manufacturer's trade name. All wiring shall be color coded as follows:

PHASE	120/208 VOLTS	277/480 VOLTS
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

- F. Wiring in sizes up to #8 shall have colored insulation, wiring in sizes #6 and larger shall be coded by colored tape applied no more than 6 inches (150 mm) from each termination and spanning a minimum length of 6 inches (150 mm) of insulation.
- G. All emergency wiring shall be clearly identified as emergency in all outlets, fixtures, etc.
- H. Direct burial conductors and cables shall be Type USE (UL 44).

2.2 MINERAL INSULATED (MI) CABLE

- A. Type MI cable shall be mineral insulated, metal sheathed cable, factory assembled, with one or more conductors insulated with highly compacted magnesium oxide insulation, sealed in a liquid-tight and gas-tight continuous copper sheath.
- B. Conductors shall be of solid, high electrical conductivity copper with a cross-sectional area equivalent to AWG sizes.
- C. Type MI cable shall be UL listed and labeled for two-hour fire resistance classification.
- D. Fittings and terminations shall be listed and labeled for use with type MI cable.
- E. Type MI cable shall be as manufactured by Pyrotenax and shall have the approval of the authority having jurisdiction.

2.3 CABLE REELS

- A. Cable reels shall retrieve and store loose power cables when not in use. Cable reels shall allow power cables to be pulled out to desired length, locked, and retracted for storage when not in use. Cable locking ratchets shall prevent constant tension on the cable.
- B. A collector ring and brush assembly shall transfer electrical power from the stationary base to the retractable power cable.
- C. Cable reels shall utilize wound steel springs. The reels shall be designed such that less than 70 percent of the available spring turns are used to meet the cable payout specified.

- D. The number and size of conductors of the cable reels shall match the branch circuit ratings indicated on the Drawings. All cable reel assemblies shall include a grounding conductor, and in no case shall the conductors be smaller than #12 AWG.
- E. Cables shall be type SO extra-flexible for reeling service and consist of a minimum of 65 strands of #30 AWG copper wire. Cables shall have a neoprene oil resistant jacket. Cables shall be provided by the cable reel manufacturer. Cables shall be a minimum of 20 feet (6 m) in length.
- F. Cable reels shall be of heavy-duty construction suitable for indoor or outdoor service. The cable reels shall be capable of lifting and rewinding a fully extended cable including any accessory wiring device on the end of the cable.
- G. Cable reels shall be designed to permit payout and retrieval of cable at angles of 0 - 30 degrees from vertical center. Rollers shall be utilized to reduce wear on the cable jacket.
- H. Cable shall be provided with NEMA 5-20R receptacles constructed from impact-resistant nylon suitable for heavy-duty service. The receptacles shall be completely insulated and shall incorporate an integral cable grip.
- I. Cable reels shall be provided with junction boxes suitable for hard wiring to the branch circuit indicated on the Drawings.
- J. Cables shall be provided with adjustable ball stops.

2.4 METAL CLAD (MC) CABLE

- A. The maximum allowable branch circuit conductor size utilizing MC cable shall be #10 AWG.
- B. The following standards shall apply:
 - 1. UL Standard 1569 for MC Cable
 - 2. UL Standard 83 for Thermoplastic Insulated Wires
 - 3. Federal Specification J-C-30B
 - 4. NEC Article 330
- C. Each circuit conductor and the grounding conductor shall be solid, uncoated copper insulated with PVC and jacketed with nylon complying with the physical and electrical requirements of UL Standard 83 for type THHN.
- D. All cables shall contain a green THHN grounding conductor.
- E. The cables shall be rated 194°F (90°C) and 600 volts.
- F. Cables which are intended for wiring systems in hospitals, nursing homes, and all other health care related facilities shall comply with NEC - Articles 330 and 517. Cables for use in plenum ceilings shall comply with NEC 300-22 (C).
- G. Fittings: As specified in Division 26 "Raceways" for flexible metal conduits.

2.5 ALUMINUM CONDUCTORS

- A. Aluminum conductors shall not be permitted.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring shall not be installed until building is under roof.
- B. All wiring for lighting and power circuits shall be sized as follows unless otherwise indicated:

120 Volt Branch Circuit Length	Wire Size
0-75' (0-22.5 m).....	#12
75-150' (22.5-45 m).....	#10
Over 150' (Over 45 m).....	# 8
277 Volt Branch Circuit Length	Wire Size
0-200' (0-60 m).....	#12
Over 200' (Over 60m).....	#10

- C. In accordance with the above where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, it is the Contractor's responsibility to ensure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.
- D. Emergency lighting and exit sign circuits shall not be installed in raceway, boxes, etc. with other wiring systems, except at lighting fixtures.
- E. Wire pulling compounds shall be polywater or equivalent. The use of oils and greases shall not be permitted.
- F. All field-installed control wire and cable terminating in motor control centers, panelboards, junction boxes, etc. shall be identified with pre-stamped tubular type markers or pressure sensitive linen labels covered with clear heat shrinkable tubing. Labels shall indicate circuit numbers, terminal numbers, etc. of each conductor. The identification labels shall be as manufactured by the W.H. Brady Company, Tyton, or equivalent.
- G. No conductors shall be installed in raceways before the raceway system is properly installed and all work on the building which is liable to injure the conductors has been completed. Immediately before installing the conductors, the raceway, fittings and boxes shall be thoroughly cleaned and dried.
- H. The sharing of the neutral conductor for branch circuits is prohibited unless specifically called for on the drawings.
- I. Conductors shall be continuous between cabinets, outlets and/or junction boxes; no splices or taps shall be made within the raceway itself. Under no circumstances shall feeder conductors be spliced.
- J. At least six inches (150 mm) of free conductors shall be left at each outlet, cabinet, junction box, etc. where they are connected or spliced.
- K. Wiring devices shall not be used as splices; pigtails (line, neutral and grounding) from circuit wiring shall be provided to allow removal of the device without opening the circuit.

- L. Wiring in cabinets shall be neatly laced or tied.
- M. Cable reels shall be secured to the overhead structure. Ceiling support wires and framing shall not be used to support cable reels.
- N. Cable reel ball stops shall be adjusted to provide a maximum retracted height for receptacles at 78 inches (1950 mm) above the finished floor.
- O. Provide a grounded circuit conductor (neutral) to all wall switch locations.

3.2 MINERAL INSULATED (MI) CABLE INSTALLATION

- A. Cable shall be clipped directly to walls, beams or ceilings using clips or straps supplied by the manufacturer. Fire rated circuits must be secured to a two-hour fire rated surface using supports not to exceed 3 feet (900 mm) on center. Spacing of supports for non-fire rated circuits shall not exceed 6 feet (1800 mm) on center.
- B. Exposed runs of cables shall be installed parallel to building lines to present a neat appearance. When subject to potentially damaging abuse, cables should be protected by angle iron, channel or short pieces of conduit.
- C. .
- D. Minimum bend radius shall be as recommended by the manufacturer but in no case shall be less than five (5) times the cable diameter.
- E. Multiple runs of single conductor cables shall be run close together with sheaths touching throughout the length of the run. Single conductor cables in parallel shall be "phased out" in groups and the groups spaced at least two (2) cable diameters apart. Parallel cables shall be the same length, have the same conductor material, be the same size in circular mil area, have the same insulation type and be terminated in the same manner.
- F. The cables shall be terminated with glands and seals supplied by the manufacturer and approved for the application and installed according to the manufacturer's recommendations. Ordinary locations and areas classified as Division 2 Hazardous shall use standard termination and sealing compound. Areas classified as Division 1 Hazardous shall use hazardous location terminations and sealing compound.
- G. Stripping tools, pot wrenches, crimping and compressing tools designed for the purpose shall be used to prepare the cable and install the glands and seal assemblies.
- H. Upon completion of the terminations, the insulation resistance of the cable shall be checked with a 500 volt insulation tester and a resistance value achieved which is in accordance with the manufacturer's specifications.
- I. Fire rated joints and splices shall be provided by the manufacturer.
- J. A brass plate 1/4" (6 mm) minimum thickness shall be used for terminating single conductor cables carrying currents in excess of 200 amperes.

3.3 METAL CLAD (MC) CABLE INSTALLATION

- A. MC cable shall not be used for feeders or branch circuit homeruns.
- B. Minimum bend radius shall be as recommended by the manufacturer.

- C. MC cable may only be used for lighting whips; maximum 6 foot length, in accessible locations. No other use is permitted.

3.4 TESTING

- A. Circuits shall be tested to ensure electrical continuity and to ensure the system is free of short-circuits.

END OF SECTION 260519

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies general grounding and bonding requirements for all electrical installations.

1.2 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.
- B. Motorola R56 Standards and Guidelines for Communication Sites (latest edition) applies to this section.

1.3 SUMMARY

- A. All systems, circuits and equipment shall be grounded and bonded in accordance with Article 250 of the National Electrical Code and the requirements of these Specifications and the Drawings. In addition to NEC requirements, all systems, circuits, and equipment shall be grounded and bonded in accordance with the latest edition of the Motorola R56 Standards and Guidelines for Communications Sites.

1.4 SUBMITTALS

- A. In accordance with section Submittals and Division-26 Section, "Basic Electrical Materials and Methods", the following shall be furnished:
 - 1. Test Reports: Certified test reports of ground resistance.
 - 2. Certifications: Two weeks prior to final inspection, deliver to the Owner six (6) copies of the certification that the materials and installation are in accordance with the drawings and specifications and have been properly installed.
 - 3. Provide product data for all grounding and bonding components and accessories.

1.5 QUALITY ASSURANCE

- A. All grounding components and accessories shall comply with and shall be installed in accordance with NFPA 70, Article 250 of the National Electrical Code, and applicable sections of UL Std 467, "Electrical Grounding and Bonding Equipment", and UL Std 869, "Electrical Service Equipment". In addition, all grounding and bonding components and accessories shall comply with the latest edition of the Motorola R56 Standards and Guidelines for Communication Sites.
- B. Grounding and bonding components and accessories shall be UL listed and labeled for the specific application for which they are being used.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

- A. Provide electrical grounding and bonding components and accessories including, but not limited to, cables and wires, connectors, terminals, jumpers and surge arresters as required for a complete installation.
- B. Where more than one product meets the intended requirements, selection shall be at the discretion of the Installer.
- C. Provide electrical insulating tape, heat-shrinkable tubing, welding materials, straps and jumpers as recommended by manufacturer's written instructions and in accordance with standard industry practices.
- D. All below grade grounding connections shall be exothermic welds and splices and shall be by Cald weld or equal. All materials shall be supplied by one manufacturer to ensure compatibility.

2.2 GROUNDING CONDUCTORS

- A. Provide a grounding conductor with green insulation.
- B. General purpose insulating grounding conductors have insulation types as identified by the NEC and tested, certified, and labeled in accordance with UL Standards.
- C. Non-insulated grounding conductors shall be bare, soft drawn, single or multiple strand annealed copper in wire gauges or sizes as shown on the drawings or consistent with the requirements of NEC Article 250.

2.3 GROUND RODS

- A. Ground rods shall be copper clad, solid steel round bars, 3/4 inches (19 mm) in diameter and 10 feet (3 m) in length.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. All equipment, conduit systems, raceway systems, metallic enclosures of electrical devices, switchgear enclosures, transformer frames and equipment, wiring devices and all metallic non-current carrying devices, etc. shall be completely grounded in accordance with the requirements of the National Electrical Code (latest edition).
- B. In addition to NEC requirements, all systems, circuits, and equipment shall be grounded and bonded in accordance with the latest edition of the Motorola R56 Standards and Guidelines for Communication Sites.
- C. Grounding conductors shall be installed within conduit and shall be sized in accordance with NEC Article 250.
- D. Grounding conductors installed below grade shall be buried at least 24" below grade.
- E. Continuity of rigid steel raceways shall be insured by conduit hubs. All grounded neutral conductors shall be continuously identified. All grounding and bonding connections shall be solderless. All grounding and

bonding connections to structural steel shall be exothermic welds. Ground fittings at water system connections shall have rigid clamp jaws. Perforated grounding straps shall not be acceptable.

- F. The secondary neutral conductor of transformers shall be continuous, identified throughout and grounded in an approved manner to the grounding electrode system. Conductor used to ground neutral conductor shall be sized in accordance with NEC Article 250.
- G. Provide insulated grounding conductors for all feeders and branch circuits. Provide grounding blocks, terminals, etc. for connection of ground wires in all distribution equipment, outlets, junction boxes and utilization equipment.
- H. Provide bonding for all metal piping systems and structural steel. Provide bonding connections to cold water and hot water, metal sanitary, gas piping and structural steel. Provide braided copper jumpers at meter, valves, equipment, etc. Bonding shall be in accordance with NEC Article 250.
- I. All grounding wire, lugs, jumpers and bus shall be copper except as specifically approved elsewhere in these Specifications.
- J. Where parallel feeders are used, each raceway shall contain an equipment ground conductor sized in accordance with NEC Article 250 for the combined parallel circuit amperage.
- K. Grounding electrode conductor shall be continuous and no splicing shall be allowed. Equipment grounding conductor splices shall be permitted in device boxes and pulling points, but should be minimized to keep ground resistance as low as possible.
- L. Receptacles shall be bonded to their outlet boxes with #12 copper straps. Straps may be omitted if self-grounding devices are utilized.
- M. .

3.2 TESTING

- A. The ground resistance at the main switchboard ground bus shall not exceed 10 ohms.
- B. The ground resistance at outdoor pad mounted equipment shall not exceed 5 ohms.
- C. Resistance shall be tested by the fall of potential method according to IEEE 81.
 - 1. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - 2. If resistance levels are excessive, take additional steps to reduce resistance to acceptable levels (at no cost to the owner). Drive additional ground rods, provide additional grounding electrode conductors, etc. as needed to reduce resistance. Describe methods used to improve results within test report.
- D. Certified test results shall be provided in accordance with the requirements of Division-26 Section, "Inspections, Testing and Start-up" of these Specifications.

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. Support all raceways, enclosures, cabinets, boxes, and related electrical equipment from the building structure as required by the NEC and as described in these Specifications.
- B. Support all lighting fixtures as required by the NEC and as described in these Specifications.

1.3 SUBMITTALS

- A. Provide product data for each type of manufactured supporting device.
- B. Provide shop drawings for each type of fabricated supporting device.

1.4 QUALITY ASSURANCE

- A. All components and the installation of all components shall comply with NFPA 70, "National Electrical Code," requirements.
- B. All supporting devices shall be listed and labeled by UL, ETL, CSA or a Nationally Recognized Testing Laboratory (NRTL).
- C. Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports and equipment mounting.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

- A. Nails, wires, perforated tape or plumber's tape are unacceptable for supporting or securing conduits.

2.2 MANUFACTURED SUPPORTING DEVICES

- A. Supporting devices shall comply with manufacturer's standard design and construction, fabricated from standard materials in accordance with published product information. Supporting devices shall use threaded means, click or snap type devices shall not be used.
- B. Supporting devices shall be protected with a zinc coating or with a similar corrosion resistant coating or treatment. Devices for use outdoors shall be hot-dip galvanized.

- C. Raceways shall be supported using clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- D. Steel channels and associated support rods shall be selected to accommodate weight of associated raceway and wire.
- E. Anchors shall be provided of adequate size to support the load, and shall be compatible with the construction method encountered. Anchors shall be expansion or toggle bolt type.

2.3 FABRICATED SUPPORTING DEVICES

- A. Pipe sleeves shall be fabricated from galvanized sheet steel or Schedule 40 galvanized steel pipe.
- B. Sheet steel sleeves shall be round tube closed with snaplock, joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge steel: 3" (75 mm) and smaller, 20 gauge (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gauge (1.6 mm); over 6" (150 mm), 14 gauge (2.0 mm).
- C. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
- D. Steel brackets shall be fabricated from angles, channels and other standard shapes. Brackets shall be assembled using welds and/or machine bolts to form a rigid assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instruction and following recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Install supports within maximum spacing indicated by NEC or on drawings.
- D. Individual conduits shall be secured with steel pipe straps or lay-in pipe hangers.
- E. Multiple runs of suspended conduit shall be supported from trapeze style hangers.
- F. Multiple runs of conduit on ceiling or wall surfaces shall be mounted on flush or surface steel channels.
- G. Ceiling support wires shall not be used for support of conduits.
- H. Lighting fixtures shall be supported as recommended by the manufacturer. Recessed LED incandescent and fluorescent fixtures in suspended ceilings shall not be supported by the ceiling system. Fixtures shall be secured to the building's structure.

- I. Raceway supports shall be adequate to carry present and future load multiplied by a safety factor of at least four. In no case shall a support strength of less than 200 pounds (1380 kPa) be used.
- J. Manufactured watertight and fire-rated seals shall be provided for sealing conduits and cables passing through sleeves in floors and fire-rated walls. Seals shall be fire-resistant rubber plugs or other materials specifically designed to provide a watertight seal and a UL listed fire-resistant rating which meets or exceeds the rating of the floor or wall.
- K. All penetrations through floors or fire-rated walls shall be sealed to restore the fire rating around such penetrations. The sealing system shall fill all voids, shall be specifically designed for such use, and shall have a UL listed fire-resistant rating which meets or exceeds the rating of the floor or wall.
- L. Mechanical Sleeve Seals: Provide mechanical sleeve seals for sleeves located in foundation walls below grade, or in exterior walls. Loosely assemble rubber links around conduit with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.
- M. Cable supports shall be provided for vertical conduits in accordance with NEC Article 300. Cable supports shall be multi-section wedge-type plugs with an outside diameter and the number and size of openings required for the conduit and conductors.
- N. Provide vibration isolators between enclosures of all vibration producing equipment, transformers, etc., and their supports or floor. Isolators shall be Mason Industrial type NK neoprene and cork sandwich or equal.
- O. Supports are required within 3 feet (900 mm) of each outlet box, junction box, device box, cabinet, conduit body or other tubing terminations.
- P. All junction boxes shall be supported from structure.

END OF SECTION 260529

SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. All wiring shall be installed in raceways as hereinafter specified, unless otherwise indicated.

1.3 SUBMITTALS

- A. Submit product data for raceways, wireways and fittings.
- B. Submit manufacturer's written installation instructions for wireways, surface raceways and non-metallic raceways.
- C. Submit pulling calculations for all underground ductbank runs having cables larger than 4/0.
- D. For prewired surface raceway installations, submit drawings for approval showing the complete layout of all products that make up the complete system for each floor prior to installation with raceway lengths, device type (power or data), locations and circuits identified.

1.4 QUALITY ASSURANCE

- A. All raceway components and the installation of raceway components shall comply with the following standards:
 - 1. NFPA 70 "National Electrical Code"
 - 2. Applicable NEMA Standards
 - 3. Applicable UL Standards pertaining to raceway system
- B. Raceway components shall be listed and labeled by UL, ETL or CSA.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT

- A. Rigid metal conduits and couplings shall be full weight, heavy wall steel, galvanized, with threaded connections conforming to the latest editions and revisions of ANSI Standard C-80.1 and UL Standard 6 which supersedes Federal Specification WW-C-581.
- B. Fittings shall be steel or cast malleable iron by Chrouse-Hinds, O-Z, T & B, Steel City, Efcor, or equal. O-Z type "AX" or equal fittings with bonding jumpers shall be used in each rigid metal conduit passing across a building expansion joint. Type of fitting shall be properly chosen for the movement anticipated.

- C. Insulating bushings shall be used on all rigid metal conduit terminations and shall be O-Z type "B" or equal.
- D. T & B Series 141, or equal, locknuts shall be used on both inside and outside on all enclosures.
- E. O-Z type "S", or equal, cable supports shall be used in conduit risers as required by the NEC.

2.2 ELECTRICAL METALLIC TUBING

- A. Electrical Metallic Tubing (EMT) shall be galvanized, conforming to the latest editions and revisions of ANSI Standard C80.3, Federal Specifications WW-563, and Underwriter's Laboratories Standard 797.
- B. Expansion fitting with bonding jumpers shall be used in each EMT conduit passing across a building expansion joint.
- C. Steel concrete-tight (rain-tight in damp and liquid-tight in wet locations) compression type box connections and couplings with nylon insulating throats shall be used.
- D. O-Z type "SBT" or equal, insulated bushing shall be used on all EMT conduit terminations not in metal enclosures.

2.3 FLEXIBLE METAL CONDUIT

- A. Flexible metal conduit shall be steel, metal strip interlocked construction, zinc-coated, conforming to the latest editions and revisions of Federal Specification WW-C566B and Underwriter's Laboratories Standard for Flexible Steel Conduit, UL1.
- B. Liquidtight flexible metal conduit shall be type UL with PVC cover as manufactured by Anamet: trade name - "Sealtite," or "Hydrotite" as manufactured by Eastern Wire and Conduit or equal, conforming to UL360.
- C. Fittings and Connectors:
 - 1. Flexible Metallic Conduit: Steel, nylon insulated throat, equal to Crouse-Hinds ACB Series, or Thomas & Betts Tite-bite.
 - 2. Flexible Non-Metallic (Liquidtight): Steel, nylon insulated throat, equal to Crouse-Hinds Liquidator.
 - 3. Die-cast squeeze fittings will not be approved.

2.4 RIGID NONMETALLIC CONDUIT

- A. Polyvinyl Chloride (PVC) conduit shall be heavy wall Schedule 40 or Schedule 80 as noted conforming to the latest editions and revisions of Federal Specifications WC-1094, Underwriter's Laboratories Standard UL651, and NEMA Standard TC-2.
- B. All joints shall be leakproof, moisture-proof, permanent solvent cement type.
- C. Conduit and fittings shall be as manufactured by Carlon, Queen City Plastics or equal.

2.5 RIGID ALUMINUM CONDUIT

- A. Aluminum conduit shall not be used.

2.6 CONDUIT BODIES AND FITTINGS

- A. All couplings, elbows, cast fittings and conduit bodies shall be made of materials of high quality throughout and shall be a first-grade commercial product, well made and free from mechanical imperfections and defects.
- B. Bushings shall be used on all conduits to provide a smooth, well rounded, insulated surface. Bushings shall be metallic with plastic throats. The insulating material shall have a UL temperature rating of 302°F (150°C), it shall be molded-on to the metal and shall become an integral part of the bushing.
- C. Erickson or split couplings shall be used in lieu of running threads. Couplings shall be manufactured by O.Z./Gedney, or equal.
- D. Entrance seals shall be provided where conduits pass through exterior concrete or masonry walls below grade. The entrance seals shall consist of a hot dip galvanized shell, sealing gland assembly capable of providing a seal around the conduit to withstand fifty feet head of water without leakage. The shell of the seal shall have at least two (2) cast collars at a right angle to the sleeve that is embedded in the concrete. Entrance seals shall be O.Z./Gedney Type WSK, FSK or equal.
- E. Conduit hubs shall be malleable iron, zinc plated rain-tight type complete with integral insulated throat, captive O-ring seal and oversize nut. Hubs shall be Myers "Screwтите," O.Z./Gedney "Space Maker," or equal.

2.7 WIREWAYS

- A. Electrical wireways shall be of the type, size and number of channels as indicated.
- B. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match in form, fit and finish the wireway as required for a complete installation.

2.8 SURFACE RACEWAYS

- A. Surface raceways shall not be used unless specifically noted otherwise on drawings. Surface raceways shall be of the type, size, number of channels and finish specified.
- B. Surface raceways shall be low profile, steel with an ivory baked enamel finish.
- C. All raceways shall include all fittings, bases, covers, end plates and accessories with the same form, fit and finish as the raceway as required for a complete installation.
- D. Wiring and receptacles shall be factory installed leaving a 2 foot (600 mm) pigtail for field connection and properly tagged for circuit identification in the field].
- E. Snap-in covers shall be provided and all receptacles shall be identified by means of permanently etched epoxy screening indicating receptacle voltage, phase and amperage. Device plates shall be nonmetallic, high impact plastic. Plate shall be an overlapping design to cover seams. Plate color shall match raceway.
- F. Surface raceways shall be manufactured and assembled in the length and configuration as indicated on the Drawings.
- G. Aluminum extrusions shall be No. 6063-T5 aluminum alloy with wall thickness conforming to UL Standards. The overall finish shall be clear, anodized No. 204R1 heavy etched architectural class II.

- H. Steel raceways shall have a nominal material thickness of 0.040 inches (1 mm).
- I. Ground continuity shall be maintained throughout the entire raceway system.
- J. Surface raceways shall be two-channel except where specifically noted otherwise. One channel shall be used for power circuits and one channel shall be used for telephone and data circuits. Assembled base and cover shall have minimum dimensions of 4.75 inches (119 mm) high by 1.75 inches (44 mm) deep and maximum dimensions shall be 5.25 inches (133 mm) high by 2.0 inches (51 mm) deep. Base shall be dividable by means of a removable barrier section with two (2) equal compartments.
- K. Receptacles shall conform to Division-26 section, Wiring Devices.
- L. A cutting tool shall be available for the base and cover to ensure clean, square cuts.
- M. Each device shall be identified noting the panel number and circuit number from which it is fed.

2.9 POWER POLES

- A. Power poles shall not be used unless specifically noted otherwise on the drawings. Power poles shall be of the type, size, number of channels and finish specified.
- B. Power poles shall be manufactured from low profile, extruded anodized aluminum or painted steel wire duct system. Steel power poles shall have a gray enamel baked finish.
- C. All poles shall include all fittings, bases, covers, end plates and accessories with the same form, fit and finish as the pole as required for a complete installation.
- D. Wiring and receptacles shall be provided. All receptacle circuits shall be wired for the entire length of the pole and 12 inch (300 mm) pigtails shall be provided for field connections. Receptacles shall conform to Division-26 Section, Wiring Devices.
- E. Snap-in covers shall be provided and all receptacles shall be identified by means of permanently etched epoxy screening indicating receptacle voltage, phase and amperage.
- F. Power poles shall be manufactured and assembled in the length and configuration as indicated on the Drawings.
- G. Aluminum extrusions shall be No. 6063-T5 aluminum alloy with wall thickness conforming to UL Standards. The overall finish shall be clear, anodized No. A-8625-C Type 2, with minimum anodizing finish of 0.004 inch (.1 mm).
- H. Steel power poles shall be fabricated from material with a nominal thickness of 0.040 inches (1 mm).
- I. Ground continuity shall be maintained throughout the entire raceway system.
- J. Power poles shall be two-channel except where specifically noted otherwise. One channel shall be used for power circuits, and one channel shall be used for telephone and data circuits. Power poles shall be 2-1/4 inches square (1406 mm²) with two (2) equally sized compartments.
- K. Where receptacles or other devices or openings are indicated to be installed in power poles, the devices and openings shall be 18" (450 mm) AFF except where specifically noted otherwise.

2.10 IDENTIFICATION

- A. Exposed raceways shall be identified at junction and pull boxes and at points not more than 20 feet (6 m) on centers. See Division-26 Section, Basic Electrical Materials and Methods for additional identification requirements.
- B. Labels shall indicate the system voltage and/or type of service and shall have an appropriate legend, such as:
 - 1. 480 VOLTS - POWER
 - 2. 480Y/277 VOLTS - LIGHTING
 - 3. 208Y/120 VOLTS - LIGHTING
 - 4. 208Y/120 VOLTS - POWER
 - 5. 120 VOLTS - CONTROL
 - 6. TELEPHONE
- C. Labels shall appear in white letters of 1/2 inch (13 mm) minimum height on a black background. Labels shall be installed in accordance with the manufacturer's instructions and sizes shall match the conduits to which they are applied. Labels shall be ordered sufficiently prior to their need so that they will be on hand when required for installation. Failure to allow adequate time for delivery of labels, including special legends, will not be considered valid reason for substitution of labels of a different type.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Exterior locations above grade - rigid metal conduit.
- B.
- C. Exposed interior locations - electrical metallic tubing.
- D. Damp or wet locations - rigid metal conduit.
- E.
- F. Concealed interior locations, accessible, dry - electrical metallic tubing.
- G. Concealed interior locations, non-accessible, dry - electrical metallic tubing.
- H.
- I. Under raised floor area in Server Room – liquidtight flexible metal conduit with waterproof outlet boxes to match existing conditions. Minimum size shall be 1/2”.
- J. Under raised floors in all areas except the Server Room – MC cable for branch circuits, EMT for feeders.
- K. Connections to motor terminal boxes, control panels mounted on equipment, dry-type transformers and other vibration producing equipment, dry locations - flexible metal conduit, 18"-36" (450 mm-900 mm) length.
- L. Connections to motor terminal boxes, control panels mounted on equipment, dry-type transformers and other vibration producing equipment, damp and wet locations - liquidtight flexible metal conduit.

- M. Recessed lighting fixtures, between fixture and its respective outlet box - flexible metal conduit in lengths as permitted by the NEC, and providing sufficient slack to permit removal of fixture and access to outlet box.
- N. Minimum conduit size shall be 3/4" (19 mm) unless noted otherwise.
- O. Non-insulating grounding conductors installed within a raceway shall be PVC Schedule 40 (where allowed by Code) or non-ferrous conduit.

3.2 INSTALLATION

- A. Unless otherwise noted on the contract drawings, all raceways shall be installed concealed in the floors, ceilings, walls or partitions of the building, and in such a manner as not to impair the integrity of the structure. Unless otherwise specified, raceways may be installed exposed in mechanical rooms, electrical rooms, large storage spaces and in large janitor's closets, pipe shafts, suspended ceiling spaces, and where required for equipment connections. Exposed raceways shall be installed parallel or perpendicular to walls, structural members or intersection of vertical planes and ceilings, with right angle turns consisting of box-type fittings or symmetrical bends.
 - 1. Exposed conduit in finished areas shall be covered with a 16 gauge steel primed and painted metal cover, secured to an adjacent structure and painted to match adjacent surfaces.
- B. The Contractor shall exercise the necessary precautions to prevent water, dirt, plaster or trash in raceways, fittings and boxes during the course of installation; raceways, fittings, or boxes clogged in such manner that cannot be thoroughly cleaned, shall be replaced. All unconnected conduit ends shall be properly capped. Raceways shall be kept at least 12 inches (300 mm) from parallel runs of flues, steam pipes or hot water pipes. Bends and offsets shall be kept to a minimum, and they shall be made without flattening or deformation with approved hickey or bending machine; the radius of the curve of the inner edge of any field bend shall not be less than the value specified in the National Electrical Code. Raceway runs shall not exceed 100 feet (30 m) between outlets; where necessary, even though not indicated on the drawings, box-type fittings or pull boxes shall be installed. Moisture traps shall be avoided as much as possible. Except as noted, raceways shall not be installed horizontally within concrete slabs-on-grade; raceways shall be installed underground, below the slab. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where raceways cross expansion joints.
- C. Raceways shall have supports spaced not more than 8 feet (2400 mm) apart, except in vertical risers where 2 inch (50 mm) and larger rigid metal conduit may be supported at intervals not larger than 15 feet (4.5 m). Raceways shall be supported on approved types of zinc-coated wall brackets, clamps, ceiling trapeze hangers, strap hangers, or pipe straps firmly secured in an approved manner. All ends of raceways shall be reamed to remove rough edges. Raceways shall be firmly attached to sheet-metal enclosures NEMA type 1 by means of proper metallic, plastic throated bushings and locknuts; and to sheet-metal enclosures NEMA types 3, 4, 6, 12 or 13, by means of interchangeable, metallic, plastic-throated, raintight hubs. When installing locknuts and bushings, care shall be observed to see that the full number of threads project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be made up sufficiently rigid to draw the bushing into firm electrical and mechanical contact with the box; two locknuts, one inside and one outside, plus the bushing, shall be used where required. Proper electrical continuity shall be established throughout the entire raceway system. An approved compound shall be applied to all field threads before installation.
- D. All conduits shall be tested for clearance and smooth joints and then capped immediately after installation by T & B "push penny" plugs, or equal, to prevent entrance of moisture or debris.
- E. No wire shall be pulled into conduits until system is complete and the building is thoroughly dry.

- F. Conduits to outlets in demountable or dry wall partitions shall be run in ceiling spaces and not in floor slabs.
- G. Conduits turning from floor slabs up into partitions shall be totally concealed.
- H. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be suitably sealed with "Duxseal" by Johns Manville or sealing fittings to prevent accumulation of condensation.
- I. Conduits and sleeves penetrating floor slabs and fire-rated partitions shall have the chopped out space between the outer wall of the piping and the concrete sealed with fire resistant material listed by UL for use in fire rated floor and partition systems. Sleeves penetrating floor slabs shall extend 1-1/2" (40 mm) above the finished floor.
- J. Conduits less than 12" (300 mm) in length connecting outlets of adjoining rooms shall be sealed with "Duxseal" by Johns Manville to prevent noise transmission between rooms.
- K. Pull wires shall be installed in all empty conduits. Use No. 14 AWG monofilament plastic line having not less than 200-lb. (1380 kPa) tensile strength. A minimum of 12 inches (300 mm) of slack shall be provided at each end of the pull wire.

3.3 CLEANING

- A. Inspect all raceways; clear all blockages; and remove all burrs, dirt and construction debris from raceways before installing conductors.

END OF SECTION 260533

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SECTION 260534 - BOXES, FITTINGS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. Provide and install outlet boxes, pull and junction boxes, cabinets and enclosures as required by the Drawings and as required by field conditions for a complete installation in accordance with the National Electrical Code.

1.3 SUBMITTALS

- A. Provide product data for all cabinets and enclosures.

1.4 QUALITY ASSURANCE

- A. All items provided under this Section shall be listed and labeled by UL or a Nationally Recognized Testing Laboratory (NRTL).
- B. The components and installation shall comply with NFPA 70 "National Electrical Code."
- C. Enclosures shall comply with NEMA Standard 250, "Enclosures for Electrical Equipment."

PART 2 - PRODUCTS

2.1 METALLIC OUTLET BOXES

- A. Outlet boxes shall conform to UL 514A, "Metallic Outlet Boxes, Electrical," and fittings shall conform to UL 514B, "Fittings for Conduit and Outlet Boxes."
- B. Outlet boxes for indoor and dry locations shall be minimum 4" (100 mm) square or octagonal, 2-1/8 inch (53 mm) deep, zinc-coated sheet steel with stamped knockouts, threaded screw holes and mounting accessories suitable for each location and application. Straps, cable clamps, exterior rings and fixture studs shall be provided as required.
- C. Outlet boxes for outdoor or wet locations shall be minimum 4" (100 mm) square copper-free aluminum cast boxes with threaded raceway entries, threaded screw holes and mounting accessories suitable for each location and application. Straps, mounting feet, closure plugs, cable clamps, exterior rings and fixture studs shall be provided as required.
- D. Outlet boxes in concrete construction shall be of sufficient depth to keep conduits a minimum of 1" (25 mm) from the wall surface.
- E. No "thru-wall" boxes shall be used in partitions.

- F. Steel floor boxes shall be sheet steel construction, concrete tight, fully adjustable, with stamped knockouts, adjusting rings, and brass floor plates.
- G. Outlet boxes in masonry partitions shall have square corners with no mounting tabs and shall be of sufficient depth to suit the block or brick construction.

2.2 NONMETALLIC OUTLET BOXES

- A. Nonmetallic outlet boxes shall not be used.

2.3 ACCESS FLOOR BOXES

- A. Access floor boxes shall be fabricated from minimum 14 gauge galvanized steel. Boxes shall have a reinforced hinged cover with flange suitable for accepting carpet, tile or high pressure laminate. The box shall provide an unobstructed enclosure for power receptacles, data and communication outlets.
- B. Access floor boxes shall be provided with two (2) duplex receptacles, NEMA 5-20R, and two (2) duplex data outlets.
- C. Access floor boxes shall be removable from the access floor without disturbing floor panels. Access to box wiring space shall be through a removable cover on the bottom or back of the box. The top cover shall be capable of being closed with cords and cables exiting from the box. Cords and cables shall be protected from the closed cover by a retractable cable exit. When the cover is closed and no cords or cables are in place there shall be no obstructions above the floor.

2.4 PULL AND JUNCTION BOXES

- A. Pull and junction boxes over 100 cubic inches (.0016 m3) in volume shall comply with UL Standard 50, "Electrical Cabinets and Boxes."
- B. Boxes shall have screwed or bolted-on covers of the same material as the box and shall be sized to accommodate the application and the site conditions.
- C. Sheet steel boxes shall have welded seams and shall have structural bracing where required to provide a rigid assembly.
- D. All boxes for concealed work shall be constructed of minimum 12 gauge galvanized sheet steel with welded seams and shall be provided with mounting brackets. Integral bracing shall be provided where required to provide a rigid assembly.
- E. All boxes installed in wet locations or on the building exterior shall be constructed from galvanized sheet steel with gasketed covers.

2.5 CABINETS

- A. Cabinets shall conform to UL Standard 50, "Electrical Cabinets and Boxes."
- B. Backboxes shall be constructed from galvanized sheet steel, and fronts and doors shall be constructed from rolled sheet steel. Cabinets shall be NEMA 1 except as otherwise noted. Cabinets shall consist of a box and a one-piece frame front with a hinged door. Concealed fasteners shall secure front to box and provide adjustment to permit alignment of front and box.

- C. Hinges shall be flush, shall not be more than 6" (150 mm) from the top and bottom of the door, and shall be no more than 24" (600 mm) apart. Doors greater than 48" (1200 mm) in height shall have 3-point latching mechanism.
- D. Surface mounted cabinets shall have fronts of the same height and width as the box. Flush mounted cabinets shall have fronts which extend 3/4" (19 mm) beyond box in all directions.
- E. Double doors shall be provided for cabinets wider than 24" (600 mm).
- F. Doors shall have combination spring catch and key lock. All locks for cabinets of a common system shall be keyed alike.

PART 3 - EXECUTION

3.1 OUTLET BOXES

- A. Outlet boxes shall be firmly secured in place, plumb and level. Outlet boxes installed in suspended ceilings shall not be supported from the ceiling system. Outlet boxes for like devices shall have a uniform mounting height unless specifically noted otherwise.
- B. Outlet boxes over windows and doors shall be installed 7'-6" (2250 mm) above the finished floor, centered over the door or window unless otherwise noted.
- C. Outlet boxes shall be 6"-12" (150 mm-300 mm) from the strike side of the door frame when installed adjacent to a door opening.
- D. Outlet boxes at fixed work surfaces and counter tops shall be installed with the center of the box 6" (150 mm) above the work surface or counter surface unless otherwise noted.
- E. Covers shall be installed on all outlet boxes.
- F. Outlet boxes for wall mounted video equipment shall be installed with the center of the box 80" (2000 mm) above the finished floor or 6" (150 mm) below the finished ceiling, whichever is lower.
- G. Outlet boxes for electric water coolers shall be wall mounted and shall not be visible after the water cooler is installed. Mounting height shall be coordinated in the field.
- H. Coordinate outlet box locations with baseboard heating units. Contractor shall adjust box locations where necessary to accommodate installation and listing requirements of baseboard heating units. Advise Owner/Engineer of any necessary adjustments. Outlet boxes shall be installed above hydronic baseboard heat and below electric baseboard heat.
- I. Outlet box mounting heights are as indicated. Mounting heights shall be to the center line of the box.

3.2 PULL AND JUNCTION BOXES

- A. Pull and junction boxes shall be no smaller than 8 inches (200 mm) square by 4 inches (100 mm) deep.
- B. Boxes shall be the minimum size as required by the National Electrical Code or larger as indicated on the Drawings.

- C. Junction and pull boxes shall be furnished and installed where indicated on the Drawings or where required by the NEC.
- D. Boxes for communication, data and signaling systems shall be 50 percent larger than the size required by the NEC and shall be located to permit ready access for installation of future raceways and conductors.

3.3 CABINETS AND ENCLOSURES

- A. Fronts of cabinets and enclosures shall be mounted straight and plumb with building surfaces.
- B. Cabinets and enclosures 68" (1700 mm) or less in height shall be installed with the top of the cabinet or enclosure 72" (1800 mm) above the finished floor. All cabinets and enclosures shall be installed in accordance with the NEC.
- C. Cabinets and enclosures installed adjacent to one another shall be installed with the tops of the cabinets and enclosures at the same height.
- D. Cabinets and enclosures in finished areas shall be flush with the walls. Cabinets and enclosures in mechanical and electrical rooms shall be surface mounted unless otherwise noted.

3.4 GROUNDING

- A. All metallic boxes, cabinets and enclosures shall be effectively grounded in accordance with Article 250 of the NEC.
- B. Provide a grounding terminal in the interior of all boxes, cabinets and enclosures.
- C. Provide additional grounding as required by the Motorola R56 Standards and Guidelines for Communication Sites

3.5 CLEANING

- A. After installation, clean and repair all boxes, cabinets and enclosures. Galvanized finishes shall be repaired using a zinc-rich paint as recommended by the manufacturer. Painted finishes shall be repaired using a matching paint from the manufacturer.

END OF SECTION 260534

SECTION 260573 - COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall engage the services of a qualified professional engineer to perform a short circuit and protective device coordination study and an arc flash hazard analysis. The study shall be stamped by a professional engineer registered in the state of Maryland. The Contractor is responsible for providing all pertinent information required by the preparers to complete the study. The study shall be performed in strict accordance with these specifications.
- B. The study shall include all portions of the electrical distribution system from the utility overcurrent device down to and including the 208Y/120 volt branch circuit panelboards to include all new equipment being installed as part of this project as shown on drawings E7.03, E7.04, and E7.05. The study shall include all new equipment installed as part of this project and shall include existing equipment upstream and downstream of new equipment as required to confirm coordination between existing and new equipment.
- C. The study shall be completed using the most current versions of NFPA 70E, Standard for Electrical Safety in the Workplace and IEEE-1584, Guide for Performing Arc-Flash Hazard Calculations.

PART 2 - PRODUCTS

2.1 SHORT CIRCUIT STUDY

- A. The Contractor shall provide a short circuit study for the electrical distribution system. The study shall include the calculation of three phase bolted fault values and phase to ground fault values at every point of application of a protective device on the system. Momentary and interrupting duty values shall be calculated.
- B. The contractor shall obtain a letter from the utility company indicating what the available fault current and X/R ratios are at the service entrance. Provide the letter in an appendix of the report.
- C. The short circuit calculations shall be performed by a computer program. Provide a computer generated single line diagram showing calculated and rated fault levels for each piece of electrical equipment.
- D. The short circuit study report must include a complete index of fault bus identifications. A system diagram indicating system configuration and the fault bus locations shall be provided in the study.
- E. Provide a complete printout of the results of the calculations.
- F. Momentary duty fault values shall be tabulated for both three phase and phase to ground faults including: bus identification, bus L-L voltage, symmetrical fault current values, symmetrical fault kVA values, and X/R ratio at each fault bus.
- G. Interrupting duty fault values shall be tabulated for both three phase and phase to ground faults including: bus values, symmetrical fault kVA values, X/R ratio at each fault bus, asymmetry factor at each fault bus, and the associated asymmetrical fault value at the bus.

- H. Manufacturer's published interrupting/withstand capabilities shall be compared to calculated fault current values to determine acceptability of each protective device installed on the system. A tabulation shall be provided detailing the comparison.
- I. The short circuit study shall report any deficiencies in interrupting capabilities and include recommendations for correcting such deficiencies.

2.2 PROTECTIVE DEVICE COORDINATION STUDY

- A. The Contractor shall provide a protective device coordination study for all protective devices installed on the electrical distribution system.
- B. The coordination study shall begin with the first upstream utility protective device and continue down through the distribution system to the first device on each feeder which does not have adjustable trip characteristics.
- C. Time-current coordination curve sheets shall be developed on log-log paper utilizing manufacturer's published time-current characteristics. Key coordination elements shall be plotted to demonstrate the level of coordination provided.
- D. Transformer damage characteristics as specified in American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI and IEEE) guidelines and inrush points shall be plotted to demonstrate the level of protection provided. Cable insulation withstand curves shall also be plotted to demonstrate protection provided.
- E. Each curve sheet shall have a single line diagram indicating the portion of the system being plotted.
- F. Each curve sheet shall be accompanied by a detailed narrative explaining the coordination provided, and any compromises made between protection and selectivity.
- G. The coordination study report shall provide complete tabulations of all protective devices, ratings and settings. Recommendations shall be provided to improve coordination where necessary.
- H. Distribution system A and distribution system B as shown on drawings E7.03, E7.04, and E7.05 are emergency systems in accordance with NEC Article 700. Provide a statement in the study confirming that selective coordination has been achieved in accordance with NEC Article 700 requirements using the project specific equipment. This will require specific coordination with the overcurrent protection device equipment vendor(s) to coordinate equipment types and characteristics to ensure selective coordination prior to submitting the coordination study.

2.3 ARC FLASH HAZARD ANALYSIS

- A. Provide arc flash hazard calculations for all electrical distribution equipment identified in NEC Article 110.16, Flash Protection.
- B. Provide arc flash hazard calculations per IEEE-1584. Calculations shall provide the flash protection boundary (ft.), arc flash hazard category and the required personnel protective equipment (PPE) for all electrical distribution system equipment included in the Arc Flash Hazard Analysis. Also provide incident energy level as calculated in analysis.
- C. Provide an arc flash hazard warning label on all electrical distribution system equipment included in the Arc Flash Hazard Analysis. The label shall comply with ANSI Z535.4-1998, Product Safety Signs and

Labels. The label shall include, but not be limited to, the flash protection boundary, flash hazard category, and required PPE.

- D. Provide painted arc flash protection boundary line on floor in front of each piece of equipment involved in the arc flash hazard analysis. Painted line shall be minimum 4" wide with a painted stencil label stating "Arc Flash Protection Boundary". Color of painted line to be approved by the Owner.

PART 3 - EXECUTION

3.1 REPORT

- A. The short circuit and coordination study shall be completed prior to releasing for manufacture of all switchboards, fused switches, panelboards, circuit breakers and other equipment with overcurrent protection. Coordinate with the equipment provider prior to submitting the coordination study. Submit the coordination study at the same time as the associated electrical distribution system equipment submittal.
- B. Six (6) copies of a bound report shall be submitted for review and approval at the completion of the short circuit and coordination study. The report shall contain all of the items required by these specifications. The report must be submitted prior to the delivery of any distribution equipment submittals. This will be strictly enforced. Submittal reviews of distribution equipment shall be withheld until the report is received, reviewed, and approved.
- C. Time-current coordination curve sheets may be reduced to 8-1/2 x 11 size for inclusion in the report. However, full size curve sheets shall be provided, not necessarily bound, with each copy of the report.
- D. The Contractor shall warrant that errors and omissions in the study or report shall be corrected without charge to the Owner when so found within twelve (12) months from acceptance of the first report.
- E. Copies of the approved study shall be included in the manuals specified in Division-26 Section, "Basic Electrical Materials and Methods."

END OF SECTION 260573

SECTION 262200 - TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. Furnish and install general purpose and specialty dry type transformers as specified herein and as indicated on the Drawings.

1.3 SUBMITTALS

- A. Provide product data for each type and rating of transformer. Data shall include dimensional plans, sections, and wiring diagrams indicating factory and field wiring.

1.4 QUALITY ASSURANCE

- A. All transformers and the installation of all transformers shall comply with NFPA 70, National Electrical Code, and Maryland Energy Efficiency Standards Act (EESA), enacted into law on March 1, 2005.
- B. Transformers provided under this section shall conform to applicable standards from UL and shall be listed and labeled by UL or a Nationally Recognized Testing Laboratory (NRTL).

PART 2 - PRODUCTS

2.1 DISTRIBUTION TRANSFORMERS

- A. Basis of design: Square D. Provide products manufactured by Square D or approved equal by Eaton or General Electric (GE). Equipment shall meet all requirements of this specification and associated drawings for consideration of approved equal.
- B. Transformers shall be dry type, air cooled, designed for 60 Hz service, having ratings and characteristics as indicated on the Drawings. Ventilated and non-ventilated transformers shall be provided with UL listed enclosures.
- C. Transformers rated below 30 KVA shall have 365°F (185°C) insulation system and shall be designed for 239°F (115°C) rise above a 104°F (40°C) ambient.
- D. Transformers rated 30 KVA and larger shall have 428°F (220°C) insulation system and shall be designed for 302°F (150°C) rise above a 104°F (40°C) ambient.
- E. Cores shall be fabricated from grain oriented, non-aging silicon steel.

- F. Coils shall be continuous without splices. Terminations shall be brazed or welded. Shielded transformers shall incorporate an electrostatic shield located between primary and secondary windings. Coil Material: **Copper**.
- G. Core and coil assemblies shall be dried, impregnated with varnish or epoxy, and cured to minimize hot spots and reduce noise.
- H. Transformers rated 30 KVA and larger shall have two (2) above normal full capacity 2-1/2 percent taps and four (4) below normal full capacity 2-1/2 percent taps. Taps shall be readily accessible and shall be set in the field.
- I. Transformers shall be quiet type, which operate at sound levels below ANSI Standard C89-2. Core and coil assemblies shall be mounted on rubber vibration isolators.
- J. Enclosures shall be cleaned and degreased, primed and finished to provide a scratch resistant and weather resistant finish.
- K. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with DOE 2016 Efficiency (10 CFR 431).
 - 2. Tested according to NEMA TP 2.

2.2 LOW TEMPERATURE RISE TRANSFORMERS

- A. Low temperature rise transformers shall be furnished and installed where indicated on the Drawings.
- B. Low temperature rise transformers shall conform to the requirements of this Section except as modified herein.
- C. The temperature rise shall not exceed 176°F (80°C) above a 24 hour average ambient temperature of 86°F (30°C) when loaded at the rated KVA.
- D. The transformer shall be capable of providing 30 percent additional capacity continuously without exceeding 302°F (150°C) rise and shall maintain a life expectancy of 20-25 years.
- E. Lower temperature rise shall not be achieved by forced air cooling or by over- ventilating the coil.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Transformers shall be located to provide adequate circulation of cooling air and shall be installed in accordance with the manufacturer's written instructions.
- B. Tighten all connectors and terminations in accordance with the manufacturer's published torque-tightening values.
- C. Transformers shall be grounded in accordance with NFPA 70, National Electrical Code.
- D. Adjust and set taps to provide optimum voltage for utilization equipment taking into account high and low voltage swings, load changes and voltage drop.

- E. Provide supports and vibration isolators in accordance with Division-26 section, “Supporting Devices.”

END OF SECTION 262200

SECTION 262270 – REMOTE DISTRIBUTION CABINET

PART 1 – GENERAL

1.1 SUMMARY

- A. These specifications describe requirements for a small-footprint, free-standing power distribution cabinet, supplying power to sensitive loads. It shall include all equipment to properly interface the AC power source to the intended load.

1.2 STANDARDS

- A. The specified system shall be designed, manufactured, tested and installed in compliance with:
 - 1. American National Standards Institute (ANSI)
 - 2. Canadian Standards Association (CSA)
 - 3. Federal Information Processing Standards Publication 94 (FIPS Pub 94)
 - 4. Institute of Electrical and Electronics Engineers (IEEE)
 - 5. ISO 9001
 - 6. National Electrical Code (NEC - NFPA 70)
 - 7. National Electrical Manufacturers Association (NEMA)
 - 8. National Fire Protection Association (NFPA 75)
 - 9. Underwriters Laboratories (UL)
- B. Units shall be UL listed as a complete system under UL 891 Standard for Switchboards and shall comply with EN and the European Low Voltage Directive and be CE marked.
- C. The specified system shall comply with latest FCC Part 15 EMI emission limits for Class A computing devices and the emission and immunity limits of EN50081-2/EN550022 Class A and EN50082-2.
- D. The system shall safely withstand without misoperation or damage:
 - 1. Transient voltage surges on the AC power input as defined by ANSI/IEEE C62.41 for Category B3 locations (industrial and commercial facilities with high surge exposure)
 - 2. Electrostatic discharges (ESD) up to 10 kV at any point on the exterior of the unit
 - 3. Electromagnetic fields from portable transmitters within 3 ft. (1m) of the unit.

1.3 SYSTEM DESCRIPTION

- A. Electrical Requirements:
 - 1. Input/Output voltage shall be 208Y/120 volts AC, 60Hz, three-phase, four-wire-plus-ground.
- B. Environmental Requirements:
 - 1. Storage temperature range: -67° to +185°F (-55° to +85°C).
 - 2. Operating temperature range: +32° to 104°F (0° to 40°C).
 - 3. Relative humidity: Operation shall be reliable in an environment with 0% to 95% noncondensing relative humidity.

4. Operating altitude: Up to 6,600 ft. (2,000m) above Mean Sea Level. Derated for higher altitude applications.
5. Storage/transport: Up to 40,000 ft. (12,200m) above Mean Sea Level.
6. Audible noise: The audible noise level of the specified system shall be less than 45dBA.

1.4 DOCUMENTATION

A. Drawings:

1. Wiring diagrams and drawings of major components shall be furnished.

B. Spare Parts:

1. A list of recommended spare parts shall be supplied at the customer's request.

C. User's List:

1. An in-service user's list shall be furnished upon request.

1.5 WARRANTY

- A. The manufacturer shall provide a one-year warranty against defects in material and workmanship for 12 months after initial startup or 18 months after ship date, whichever occurs first.

1.6 QUALITY ASSURANCE

- A. The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi-Pot" Test, two times rated voltage plus 1000 volts, per UL requirements (and Metering Calibration Tests). The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the work include, but are not limited to the following:
 1. Liebert RDC Remote Distribution Cabinet (Basis of Design)

2.2 COMPONENTS

A. Frame Construction and Enclosure:

1. The frame shall be constructed of galvanized steel and pop riveted to provide a strong substructure. The cabinet shall be a freestanding NEMA type 1 enclosure and meet IP20 requirements. The unit shall have lockable, removable, hinged doors. The unit shall have easily removable and interchangeable output cable trays to allow matching of the size and number of cable/conduit

openings to the site requirements. A minimum of 168 cable/conduit openings with plastic plugs shall be provided. All service shall be capable of being performed with access to the front and rear, plus one side for installation flexibility. Retrofitting additional power distribution cables shall require access to the front or rear of the unit only. A tool shall be required to remove the exterior panels that access the hazardous voltage area of the unit. Hinged doors shall provide access to the main panelboard circuit breakers and to all output circuit breakers. The color of the exterior doors and panels shall be manufacturer's standard color.

2. The unit shall be naturally convection-cooled. No fans for forced-air cooling system shall be used. The convection cooling method shall allow continuous full-load operation. Heat rejection shall be through a screened protective top that prohibits entry of foreign material.
3. The cabinet dimensions shall be a maximum of 24 in. wide by 78 in. high by 26 in. deep (610 x 1981 x 660mm) to allow installation in a single raised floor panel location. The distributed floor weight shall be less than 250 lb./sq.ft. (1225 kg/sq. m). Remote distribution cabinet construction shall allow cabinet and all connections to be used on an 8" (6-1/2" available space below floor) raised floor application.
4. All bus shall be copper.

B. Input Power Connections:

1. Input power conductors shall connect to the main panelboard circuit breakers or terminal blocks. Power terminals shall be provided for connection of a 173% rated neutral and a parity-sized insulated ground.

C. Main Panelboard Circuit Breaker:

1. Each distribution panelboard shall be protected by a main panelboard circuit breaker. The breaker shall be UL listed and IEC rated for use at the system voltage. The breaker shall have a rating of 100 amperes, with an interrupting rating of 10kA RMS. Breaker shall be mission critical type with LSI trip unknit for selective coordination with upstream and downstream overcurrent protective devices.

D. Distribution Panelboards;

1. The specified system shall contain two vertically mounted Square D or approved equal bolt-in panelboard(s) for distribution to the intended loads. The panelboards shall be accessed from the front of the unit. Each panelboard shall be totally enclosed with a hinged accent panel that provides access to that panelboard without exposing other portions of the unit. The hinged accent panel shall include mechanical adjustments to allow for proper fit over the branch breakers. The panelboard shall have a rating of 100 amperes, with an interrupting rating of 10kA RMS. Each panelboard shall provide a total of 42 single-pole branch circuit breaker positions. Each panelboard shall include separate isolated neutral and safety-ground busbars for the neutral and safety-ground connections for at least 42 output circuits. The neutral busbar and wiring shall be sized for at least 1.73 times the panelboard full load rating to accommodate high harmonic neutral currents associated with single-phase nonlinear loads.

E. Branch Circuit Breakers:

1. Each load shall be protected by an individual branch circuit breaker. Single-pole, two-pole and three-pole (plug-in) (bolt-on) type branch breakers up through 100 amperes shall be utilized. Each branch circuit breaker shall provide overcurrent protection and shall clearly indicate the ON, OFF and TRIPPED positions. All branch circuit breakers shall have a minimum interrupting rating of 10kA RMS at 208Y/120 VAC. Each branch circuit breaker shall be sized in accordance with the NEC and shall be UL/CSA listed. Branch circuit breakers shall have an associated directory label identifying the branch circuit number and the equipment being served.

F. Output Distribution Cables:

1. The cable supplying each load shall consist of UL/CSA listed liquid-tight, flexible metal conduit containing the required THHN copper insulated power, neutral and parity-sized ground conductors. The flexible conduit shall be liquid-tight, insulated and shielded to minimize electrical or mechanical disturbances to the conductors. The length of each cable and the type of receptacle/termination shall be as shown on the drawings. Each output distribution cable shall be permanently labeled at each end of the cable with the assigned circuit number and receptacle type, equipment identification and cable length. Each cable shall be thoroughly factory-checked and factory-tested. Tests shall include continuity, phase rotation and a Hi Pot test at twice-rated circuit voltage plus 1000 volts. All output cables can be wound on spools mounted on casters to facilitate handling and installation. Each cable shall be a UL listed assembly. Liquid-tight flexible metal conduit minimum size shall be 1/2" in this area. Receptacle boxes located under the raised floor in Server Room shall be cast metal, gasketed, waterproof type.

2.3 ACCESSORIES

A. Current Monitoring Panel:

1. The current monitoring panel shall consist of a four-digit high-visibility Liquid Crystal Display (LCD) to monitor current parameters. Front LCDs shall be provided with push-button switches for operator interface. The three-phase and neutral currents for each panelboard shall be displayed. The display and switches shall be accessible without opening the door. All currents shall be monitored using true RMS measurements for accurate representation of non-sinusoidal waveforms typical of computers and other sensitive loads.

B. Enhanced Monitoring Panel:

1. The enhanced monitoring panel shall consist of a bright, easy to read, 12-digit (three lines of four digits each), 3/4-in. high, LED display to monitor voltage, current and power parameters. Front and rear displays shall be provided, each with a toggle switch to allow an operator to view data for each panelboard. The displays and switches shall be accessible without opening the door. The following metering parameters shall be displayed:
 - Voltage line-to-neutral for each phase
 - Voltage line-to-line for each phase
 - Voltage line-to-neutral average
 - Voltage line-to-line average
 - Current for each phase
 - Neutral current
 - Current average
 - Current demand , for each phase and average
 - Peak current demand, for each phase and average
 - Frequency
 - Total Power Factor
 - Total kW
 - Peak kW
 - kWh
2. All voltages and currents shall be measured using true RMS techniques for accurate representation of non-sinusoidal waveforms associated with computers and other sensitive electronic loads. The metering parameters shall have a full-scale accuracy of $\pm 0.5\%$.
3. For remote monitoring, a RS-485 port that includes Modbus RTU protocol is provided for each panelboard.

C. 10kAIC Main Panelboard Circuit Breaker:

1. The main panelboard circuit breaker shall have an overall short-circuit current rating of 10kA RMS symmetrical amperes.

D. EZ-View Doors:

1. The enclosure shall be provided with lockable, hinged removable doors containing a Plexiglas opening that allows the operator to view the branch breakers without opening the door.

E. Certified Test Report:

1. A certified copy of the factory test report shall be provided for each unit.

PART 3 - EXECUTION

3.1 STARTUP AND COMMISSIONING

- A. Factory startup and commissioning for the specified system shall be provided by the manufacturer's factory authorized field personnel. The manufacturer shall directly employ a service organization of factory-trained field service personnel dedicated to the startup, maintenance and repair of the manufacturer's power equipment. The manufacturer shall maintain a dispatch center 24 hours per day, 365 days per year, to minimize service response time and to maximize availability of qualified service personnel.

END OF SECTION 262270

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. Provide a switchboard in accordance with the plans, elevations, schedules and notes on the Drawings and as specified herein.

1.3 SUBMITTALS

- A. Submit manufacturer's data sheets, wiring schematics and installation dimensional drawings for Owner/Engineer review, comments, and/or approval.
- B. Identify all specified items on submittals to assure compliance and ease of review and/or approval.
- C. Prior to final test and acceptance, submit four (4) complete sets of final data sheets, schematics and dimensional drawings in neat brochure form.
- D. Submittal data required:
 - 1. Dimensioned plan view of all equipment.
 - 2. Size and weight of individual shipping units.
 - 3. Complete diagrams of all control and power connections.
 - 4. Time - current characteristic curves shall be provided for all overcurrent devices and solid state trip devices. Curves shall be provided on standard 11 x 17 log-log sheets.

1.4 QUALITY ASSURANCE

- A. All work and materials shall conform with the requirements of NFPA 70, "National Electrical Code", the requirements of the local authority having jurisdiction, and where applicable the requirements of IBC.
- B. All materials and assemblies shall be listed and labeled by UL.

PART 2 - PRODUCTS

2.1 SWITCHBOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D (Basis of Design)
 - 2. Eaton (Cutler Hammer)
 - 3. GE/ABB

- B. The switchboard shall be dead-front, freestanding front accessible, NEMA 1 indoor construction with the required number of vertical sections to fulfill the requirements for utility metering, a main disconnect, and feeder and branch circuit distribution.
- C. Vertical sections shall be bolted together to form a rigid switchboard. Overall dimensions and shipping splits shall be arranged to comply with the dimensions indicated on the drawings and with the available access to the Electrical Equipment Rooms.
- D. The switchboard shall include all the protective devices with all required accessories, instrumentation, and control devices as indicated on the Drawings and specified herein.
- E. Readily accessible terminal blocks shall be provided for all control wiring leaving the switchboard and for all accessories furnished for customer use.
- F. The sides, top and rear shall be covered with removable screw-on steel plates having formed edges.
- G. The bus shall be silver plated copper of sufficient size and cross-section to limit the temperature rise to 149 degrees F (65 degrees C) based on UL tests. The bus shall be braced for 65,000 amperes RMS symmetrical and supported to withstand the mechanical forces exerted during short-circuit conditions when directly connected to a power source having the specified available short-circuit current.
- H. A full capacity neutral bus shall be provided in all sections. Neutral lugs shall be provided for all four-wire circuits.
- I. A ground bus shall extend the full length of the switchboard and shall be secured in each section. Ground lugs shall be provided for all circuits.
- J. Switchboard shall be provided with adequate lifting means and shall be capable of being rolled or moved into position and bolted directly to the floor without the use of floor sills.
- K. All vertical sections of the switchboard shall be aligned front and rear.
- L. All exterior and interior steel surfaces shall be cleaned and treated with a rust-inhibiting phosphatized coating and then finished with baked enamel conforming to ANSI-61 light gray.
- M. Bus shall be arranged A-B-C left-to-right, top-to-bottom, front-to-rear.
- N. Switchboard ratings shall be based on an ambient temperature of 104 degrees F (40 degrees C).
- O. The main device shall be individually mounted, stationary, completely isolated from the feeder devices. All connections to the main device shall be front accessible.
- P. The feeder devices shall be group mounted, front accessible.
- Q. Switchboard construction shall permit maintenance of incoming line terminations, main device connections, all bus bolted connections and feeder device line and load connections to be performed from the front of the switchboard.
- R. The main device section shall have a UL service entrance label.
- S. Phenolic nameplates shall be provided for all compartments, sections and circuit protective devices.
- T. Fabricate enclosure with removable, hinged trim for front access to interior of switchboard. Also, provide hinged, rear cover panels where rear access is required.

- U. Provide digital metering complete with all required metering transformers and protective devices to provide the following parameters:

Metered Values	Accuracy
AC Ampere	+ 0.5%
Phase A	
Phase B	
Phase C	
AC Voltage	+ 0.5%
Phase A-B	Phase A
Phase B-C	Phase B
Phase C-A	Phase C
Watts	+ 1.0%
VARs	+ 1.0%
VA	+ 1.0%
Watt-Hours	+ 1.0%
VAR-Hours	+ 1.0%
VA-Hours	+ 1.0%
Power Factor	- 2.0%
Frequency	+ 0.1 HZ
% THD	+ 1.0%

2.2 CIRCUIT BREAKERS

- A. The main device shall be a 100% rated circuit breaker with stored energy contact operation and ambient insensitive solid state trip device with the following functions:
- Adjustable pickup and long time delay.
 - Adjustable short-time pickup and delay with I²T function.
 - Adjustable instantaneous pickup.
 - Trip indicating targets for overload, short circuit, and ground fault.
 - I/C - 65,000 RMS sym. at 480 volts.
- B. The feeder devices shall be molded case circuit breakers of quick-make, quick-break, trip-free thermal magnetic type with frame, trip and voltage ratings, number of poles, and interrupting capacity as indicated on the Drawings and in the schedules. All breakers shall be removable from the front of the switchboard without requiring removal of adjacent units. In addition to other requirements, breakers shall have LSI trip units and accessories as shown on the drawings.
- C. The switchboard shall have space or provisions for future units as indicated on the Drawings and in the schedules. Spaces shall include all necessary bus, device mounting supports, and connections requiring only the addition of the circuit breaker.
- D. The main and feeder circuit breakers shall be equipped with suitable lugs as required for the conductors specified on the Drawings.
- E. The main breaker shall be equipped with a bell alarm contact and two (2) normally open and two (2) normally closed auxiliary contacts.
- F. The switchboard shall be provided with energy reduction maintenance switching with local status indication for all circuit breakers rated 1200 amps or larger for compliance with NEC Article 240.87, (B), (3).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install switchboards in the locations shown on the Drawings in accordance with manufacturer's written instructions and in accordance with standard accepted practices.
- B. Repair any damage to the enclosure by sanding smooth the damaged area and repainting the entire section. Paint used to repair any enclosure surfaces shall be provided by the manufacturer of the switchboard and shall match the original finish of the switchboard.
- C. Tighten connections and terminations in accordance with manufacturer's published torque tightening values. When manufacturer's values are not established, torque tighten all connections in accordance with UL 486A, UL 486B, and the National Electrical Code.

3.2 GROUNDING

- A. Provide equipment grounding connections for switchboards in accordance with the National Electrical Code and the Drawings.

3.3 TESTING

- A. After installation, check all terminations and connections for tightness and continuity.
- B. Energize the switchboard and demonstrate opening and closing operation of all overcurrent protective devices.
- C. All adjustable circuit breakers and protective relays shall be checked, tested and set by an independent Nationally Recognized Testing Lab (NRTL) in accordance with NETA specifications, the manufacturer's written instructions and Division-26 Section, Inspections, Testing and Start-up”.
- D. All protective devices shall be set in accordance with the approved coordination study. Copies of a certified test report shall be provided in accordance with Division-26 Section, “Inspections, Testing and Start-up” of these specifications.

END OF SECTION 262413

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.
- B. Cabinets and enclosures shall conform to Division-26 Section, Boxes, Fittings and Cabinets.

1.2 SUMMARY

- A. Furnish and install panelboards, cabinets and boxes as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

- A. Provide product data for all panelboards, enclosures, cabinets, overcurrent devices and accessories.
- B. Provide time-current-characteristic curves for all phase overcurrent devices rated 100 amperes or more and for all ground fault protective devices.

1.4 QUALITY ASSURANCE

- A. Panelboards shall be supplied and installed in strict conformance with NFPA 70, National Electrical Code.
- B. Products supplied under this Section shall comply with applicable requirements of UL standards pertaining to panelboards,, overcurrent devices, enclosures, and cabinets. Completed assemblies shall be UL listed and labeled.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Basis of design: Square D. Provide products manufactured by Square D or approved equal by Eaton or General Electric (GE). Equipment shall meet all requirements of this specification and associated drawings for consideration of approved equal.
- B. Panels shall be of the circuit breaker type, and shall have capacity and arrangement as shown on the panel schedules or one-line diagram.
- C. Branch circuit breakers shall be bolt-on type and shall be of the ambient compensated, thermal magnetic type, which will provide inverse time delay overload, and instantaneous short circuit protection. Branch circuit breakers shall have one, two or three poles as designated on the panel schedule. No circuit breakers utilizing handle ties for two or three pole operation shall be acceptable. Voltage and current ratings shall be as indicated on the drawings.
- D. Refer to panel schedules on drawings for exact circuit breaker arrangements and interrupting capacities. Provide circuit breakers UL listed as type HACR for air conditioning equipment branch circuits.

- E. Main breakers and branch breakers shall have the same minimum ampere interrupting capacity. Series rating shall not be acceptable.
- F. Provide a typewritten directory for each panel, placed inside the panel door. The directory shall list all rooms served by each breaker, using the "Owner's" room numbers. Directories shall be installed in a metal directory frame under glass or minimum 0.03 (.75 mm) inch thick clear non-yellowing plastic. Spares and spaces shall be written in pencil.
- G. All circuit breakers which serve time clocks, telephone and communication equipment, refrigerators, exit signs, emergency circuits, fire alarm, security, and other miscellaneous control devices shall be equipped with mechanical handle locking devices.
- H. Where panels contain contactors, the contactors shall be mounted behind a hinged, locking door. Contactor section shall be below the circuit breaker section unless otherwise noted. Provide all required barriers. Contactors shall conform to the requirements of Division-26 Section, Disconnects, Switches and Contactors.
- I. Each panel shall be equipped with a ground bus, adequate for feeder and branch circuit equipment grounding conductors; bonded to box.
- J. Each panel and cabinet and the units comprising same shall bear the manufacturer's nameplate and the UL label. Panelboards used for service entrance equipment shall be UL Service Entrance rated/labeled.
- K. All single-phase, three-wire and three-phase, four-wire panels shall be equipped with a fully rated neutral bar. The neutral bar shall be sized to accommodate oversized neutral conductors where oversized neutral conductors are indicated on the Drawings.
- L. All bus shall be copper.
- M. Cabinet and trim shall be of code gauge steel (minimum) with 4" (100 mm) (minimum) wiring gutter all around. All panelboards shall be equipped with a hinged, locking door and hinged trim. Two (2) keys shall be furnished with each cabinet, and all locks on all cabinets shall be keyed alike. Provide door-in-door panel cover with piano hinge.
- N. Where panels occur adjacent to one another in finished spaces, cabinets and doors for each panel shall be of the same height.
- O. Panelboards shall be painted with gray over rust preventive primer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount panels in locations shown, making sure that code-required clearances exist.
- B. Where cabinets cannot be set fully flush due to shallowness of partition, trim protruding sides with approved metal or hardwood molding, fastened to cabinet so as to conceal intersection of wall and cabinet.
- C. If paint is damaged during shipping or installation, damaged portion shall be sanded smooth and entire panel repainted.
- D. Provide five (5) spare 3/4" (19 mm) conduits stubbed into accessible ceiling spaces above and below each flush mounted panel.

- E. Load Balancing: After substantial completion, but not more than 60 days after final acceptance, measure load balancing and make circuit changes.
1. Measure loads during periods of normal system loading (coordinate with Owner).
 2. Perform load balancing circuit changes outside normal occupancy/working schedule of the Owner at time directed by Owner's representative.
 3. After circuit changes are completed, recheck loads during normal load period. Record all load readings before and after changes and submit test results.
 4. Tolerance: Difference exceeding 20 percent between phases within a panelboard is not acceptable. Rebalance and recheck as necessary to meet this requirement.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.
- B. The requirements for outlet boxes and device enclosures are provided in Division-26 Section, "Boxes, Fittings and Cabinets".

1.2 SUMMARY

- A. The Contractor shall furnish and install all wiring devices indicated on the Drawings or specified herein.

1.3 SUBMITTALS

- A. Provide product data for each type of wiring device specified.

1.4 QUALITY ASSURANCE

- A. All products and the installation of all products shall comply with NFPA 70, "National Electrical Code."
- B. Wiring devices shall be listed and labeled by UL and shall confirm to the latest UL and NEMA standards pertaining to wiring devices.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. All wiring devices shall be Specification Grade.
- B. Wiring devices shall be ivory in color unless otherwise indicated.
- C. Convenience receptacles shall be duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material.
- D. .
- E. Convenience receptacles serving bathrooms, toilets, garages, piers, pools, fountains, outdoor and wet locations, and construction sites shall be of the ground fault interrupter type, duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material. Ground fault interrupter type receptacles (15 and 20 amp branch circuits) shall not be required in commercial kitchens when associated branch circuit is protected by a ground fault interrupter type circuit breaker.
- F. Convenience receptacles located in wet locations shall be of the ground fault interrupter, weather resistant type, duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic, corrosion resistant material.

- G. Clock receptacles shall be single, grounding and hanger type, 15A, 2P, 3W, 125V, NEMA 5-15R, straight blade, nylon or high-strength thermoplastic material with stainless steel plate.
- H. Single throw toggle switches shall be quiet type rated 20A, 1P, 120/277 VAC.
- I. Single throw lighted toggle switches shall be quiet type rated 20A, 1P, 120/277 VAC, illuminated red polycarbonate handle. Handle shall glow when switch is on.
- .
- J. Three-way toggle switches shall be quiet type rated 20A, 120/277 VAC. Switches shall be positive-action type and shall not permit a maintained neutral position.
- K. Four-way toggle switches shall be quiet type 20A, 120/277 VAC. Switches shall be positive-action type and shall not permit a maintained neutral position.
- L. Wall plates for switches, receptacles, etc. in indoor dry areas, shall be satin finish stainless steel Type 302 for concealed raceways; and zinc-coated sheet steel or cast metal having round or beveled edges, for exposed raceways. Install galvanized steel wallplates in unfinished spaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting and installation of electrical boxes and wiring.
- C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.
- D. Install wiring devices after wiring work is completed.
- E. Install wallplates after painting work is completed.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.
- G. Protect installed components from damage. Replace damaged items prior to final acceptance.
- H. Provide weatherproof, in-use covers for all receptacles located in wet locations per NEC 406.9(B).

3.2 TESTING

- A. Prior to energizing circuits, test wiring for electrical continuity and short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six (6) times.

- B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION 262726

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SECTION 262736 - ELECTRICAL CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. The Contractor shall provide electrical connections to and between all equipment indicated on the Drawings and Schedules and in the Specifications.
- B. Electrical connections shall be provided for, but not limited to, electrical heaters; lighting fixtures; motors; motor starters and controllers; electrical distribution equipment; converters, rectifiers, transformers, and inverters; and communication, computer, clock, intercom, telephone, security, fire alarm and video systems.
- C. Unless otherwise specified, the Contractor shall, under this Section, mount and align all starters, control devices, safety switches and other related equipment whether specified in this or other Sections of the specifications, except where such items are factory mounted on the driven equipment. The mounting and alignment of starters and control devices for the automatic temperature control system are included in the Sections in which the equipment is specified.
- D. Unless otherwise specified, the Contractor shall, under this Section of the specifications, provide all wiring, including conduit, wire, junction boxes, disconnecting switches, overcurrent protection, etc., not specified elsewhere in this specification, to and between all motors, starters, control devices and related electrical equipment, whether specified in this or other Sections of this specification, except where such items are factory wired, as well as factory mounted on the driven equipment.
- E. Wiring for the automatic temperature control system is specified in other Sections of the specification.
- F. Unless otherwise specified, all wiring to motors, control equipment and related electrical equipment, shall be installed in conduits with flexible metal conduit connections utilized for final motor connections. Flexible conduits shall be large enough to accommodate motor feeder, ground conductors and control wires, whether or not so indicated on the drawings. Flexible conduits shall be limited to a maximum length of 6'-0" (1800 mm-0 mm).
- G. The drawings are diagrammatic. It is imperative that the contractor obtain exact rough-in information for all equipment well in advance of actual installation to provide coordination for his and other trades.

1.3 SUBMITTALS

- A. Submit product data for all materials and components used for electrical connections.

1.4 QUALITY ASSURANCE

- A. All materials and components and the installation of all materials and components shall comply with the requirements of the following standards:

1. NFPA 70 "National Electrical Code"
 2. IEEE Standard 241 "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings"
 3. Applicable standards of ANSI/IEEE and NEMA pertaining to the products and installation of products for electrical connections
 4. UL Standard 486A "Wire Connectors and Soldering Lugs for Use with Copper Conductors"
- B. All materials and components shall be listed and labeled by UL or ETL.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide all materials and components required for complete splices and terminations of all circuits. All wiring shall be spliced and terminated using lugs and/or terminal blocks, except as permitted elsewhere in these Specifications.
- B. All splices in branch circuit wiring rated 600 volts and less, except as permitted elsewhere in these Specifications, shall be made using compression type lugs specifically designed for the type, size and rating of the conductor. The lugs shall be installed using a tool specifically designed for the purpose.
- C. Splices in copper branch circuit wiring for sizes #12 and #10 AWG may be made with non-tool, pre-insulated, molded wire connectors with integral self-locking spring grip.
- D. All terminations of feeders and branch circuit wiring rated 600 volts or less, except as noted elsewhere in these specifications, shall be made using mechanical clamp-type set-screw lugs. Lugs which incorporate direct contact between the set-screw and the conductor shall not be permitted.
- E. Tapes:
1. Self-adhesive tapes shall be used to insulate conductor splices. Terminations shall be in conformance with the following standards:
 - a. 600 Volts, Nominal and Less: UL 510, ASTM D-2754, ASTM D-3005, and ASTM D-4388.
 - b. 600 Volts through 69 Kilo Volts: ASTM D-4388 and IEEE 48.
 2. Vinyl plastic electrical tape shall be used for all terminations and splices of conductors for circuits of 600 volts nominal and less, except terminations in motor terminal boxes, transformer terminations, lighting and all heat producing equipment terminations. Terminations of the equipment listed herein shall be insulated with pressure sensitive glass cloth tape.
 3. Ethylene propylene rubber (EPR) high voltage insulating tapes with liner shall be used for all splices and terminations over 600 volts nominal. The tapes shall be included a standard component of the manufacturer's compiled high voltage splice termination kits. All splices and terminations of 5 kV and 15 kV cables shall be accomplished with high voltage splice and termination kits only.
 4. Tapes and high voltage splice and termination kits shall be the standard product of 3M Corporation, Plymouth Rubber Company, Inc. or approved equivalent.
- F. Special lugs may be required to accommodate the size and number of conductors shown on the Drawings. The Contractor shall verify lug requirements for all circuit breakers and equipment terminals and shall provide correct lugs as required.
- G. Pre-insulated solderless ring or spade type crimp connectors and terminals shall be used for all alarm and control circuits.

- H. All connectors and terminals shall be of the proper size and ampacity, material and type for the application and service.

2.2 RACEWAYS AND FITTINGS

- A. The Contractor shall provide raceways and fittings of the types, sizes, and finish indicated for each type of service. Where the type of raceway is not specified, the Contractor shall provide and install a raceway of proper selection as determined by the installer to fulfill the wiring and equipment connection requirements and comply with NEC requirements for raceways.
- B. All raceways and fittings and the installation of all raceways and fittings shall comply with the requirements of these Specifications.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Contractor shall inspect the area where electrical connections are to be installed. The installation of electrical connections shall not be permitted until site conditions are satisfactory.

3.2 INSTALLATION

- A. The Contractor shall install all electrical connections in accordance with the manufacturer's written instructions using recognized industry practices.
- B. Power, control, data, signal and communication circuits shall be connected to equipment in accordance with the manufacturer's wiring diagrams. The Contractor shall be fully responsible for the correct termination and interface of all electrical connections.
- C. Splices shall be insulated with tape which provides an insulation rating which meets or exceeds the insulation rating of the conductor. All outdoor splices shall be made watertight using tapes and sealants specifically designed and listed for outdoor applications.
- D. Wiring devices shall not be used as splices.
- E. Electrical connections shall be tightened in accordance with equipment manufacturer's published torque tightening values. The installer shall use proper tools which shall include torque screwdriver, torque wrench, and ratchet wrench with adjustable torque settings.
- F. UL Standard 486A torque tightening values shall be used when manufacturer's published tightening values are not available.

3.3 TESTING

- A. All electrical connections shall be tested to ensure electrical continuity and compliance with these Specifications.
- B. The Contractor shall demonstrate to the Owner or Engineer that a random selection of electrical connections has been tightened in accordance with the manufacturer's published torque tightening values.

END OF SECTION 262736

SECTION 262816 - DISCONNECTS, SWITCHES AND CONTACTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. The Contractor shall furnish and install circuit and motor disconnect switches, remote control switches and magnetic contactors where indicated on the Drawings and where required by the National Electrical Code, local codes and the authority having jurisdiction.

1.3 SUBMITTALS

- A. Provide product data for each type and rating of circuit and motor disconnect switch.

1.4 QUALITY ASSURANCE

- A. Circuit disconnects and motor disconnect switches and the installation of same shall comply with the requirements of NFPA 70, "National Electrical Code."
- B. Circuit and motor disconnect switches shall be listed and labeled by UL.

PART 2 - PRODUCTS

2.1 CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. Basis of design: Square D. Provide products manufactured by Square D or approved equal by Eaton or General Electric (GE). Equipment shall meet all requirements of this specification and associated drawings for consideration of approved equal.
- B. Switches shall be constructed in accordance with the latest editions and revisions of NEMA Standard KS-1, Federal Specification W-S-685C, and Underwriters' Laboratories Standard 98.
- C. Switches shall be fusible or non-fusible as indicated on the Drawings, or as required by the equipment served, horse-power rated, quick-make, quick-break, heavy-duty type with integral arc suppressors. The handle shall be part of the enclosure, not the cover.
- D. Fused switches and fuses shall have a minimum integrated interrupting rating of 100,000 amperes RMS symmetrical.
- E. Switches 800 amperes and larger shall be bolted pressure type.
- F. Switches used for service entrance shall be service rated and bear the U.L. service entrance label.

- G. Switches shall have general purpose surface mounted NEMA type 1,3R or 4X enclosures as indicated or required by locations. All enclosures shall be designed to permit padlocking in the "open/off" position.
- H. Fused switches for motor applications shall be furnished with UL listed dual-element Class RK-1 time delay fuses rated 600 volts. Fuse current ratings shall be as indicated on the Drawings or in accordance with the motor manufacturer's recommendations when specific sizes are not specified on the Drawings.

2.2 REMOTE CONTROL SWITCHES

- A. Remote control switches shall be electrically operated, mechanically held. The main contacts shall be power driven to both the open and closed positions. Operating mechanisms which rely on gravity or permanent magnets shall not be used.
- B. The contacts and operating mechanism shall be enclosed by an insulated cover. A safe manual operator shall be provided to either open or close the switch.
- C. The main contacts shall be silver alloy composition and shall be protected by arcing contacts on sizes 600 amperes and above. Auxiliary contacts shall be rated 10A, 120 VAC. Provide one normally open and one normally closed auxiliary contact.
- D. Contacts, power and control connections, coils, and arc chutes shall be accessible and serviceable from the front.
- E. The remote control switches shall be rated in amperes for a total system load including motors, lighting ballasts, and resistive and tungsten filament lamp loads.
- F. Remote control switches shall be individually enclosed or panelboard mounted as indicated on the drawings. Enclosures shall comply with the requirements of Division-26 Section, "Boxes, Fittings and Cabinets."
- G. Remote control switches shall have a UL listed withstand current rating equal to or exceeding the available short-circuit current at the location where the switch is to be installed.
- H. The remote control switch shall be arranged for two-wire control from a maintained type control switch. All controls and modules, with the exception of the control switch, shall be located in the same enclosure with the remote control switch.

2.3 MAGNETIC CONTACTORS

- A. Magnetic contactors shall be electrically operated, mechanically held.
- B. The contacts and operating mechanism shall be enclosed by an insulated cover.
- C. The main contacts shall be silver alloy composition and shall be protected by arcing contacts on sizes 600 amperes and above. Auxiliary contacts shall be rated 10A, 120 VAC. Provide one normally open and one normally closed auxiliary contact.
- D. Contacts, power and control connections, coils, and arc chutes shall be accessible and serviceable from the front.
- E. Contactors shall be rated in amperes for a total system load including motors, lighting ballasts, and resistive and tungsten filament lamp loads.

- F. Contactors shall be individually enclosed or panelboard mounted as indicated on the Drawings. Enclosures shall comply with the requirements of Division-26 Section, "Boxes, Fittings and Cabinets."
- G. Contactors shall have a UL listed withstand current rating equal to or exceeding the available short-circuit current at the location where the switch is to be installed.
- H. The contactor shall be arranged for two-wire control. All controls and modules, with the exception of control switches, push buttons and pilot lights shall be located in the same enclosure with the contactor.

2.4 CONTROLS

- A. Push buttons shall be momentary contact, heavy duty, oiltight with legend plate. Buttons shall be fully guarded and shall be red in color.
- B. Selector switches shall be two position, heavy duty, oiltight with legend plate.
- C. Contact blocks shall be provided as required for all push buttons and switches. Contacts shall have a 10 ampere continuous current rating at 120 VAC or 120 VDC except where indicated otherwise.
- D. Pilot lights shall be heavy duty, oiltight with legend plate. Pilot lights shall utilize incandescent lamps designed for high brightness applications. Lens shall be acrylic fresnel type of the color specified.
- E. Control stations shall be recessed with sufficient space to accommodate operators as required. Provide stainless steel NEMA 1 flush cover plates.
- F. Fuel-fired equipment (for boilers, water heaters, etc.) emergency shut-off switches:
 - 1. Provide an empty device box and ¾" empty conduit from each switch location to the equipment control panel.
 - 2. Switch locations shall be at the interior and exterior of the room unless indicated otherwise by the authority having jurisdiction (AHJ). Verify exact locations with the Div.23 contractor prior to installation of boxes and raceway.

2.5 ACCESSORIES

- A. Provide electrical interlocks where indicated on the Drawings.
- B. Provide one normally open and one normally closed auxiliary contact on each switch. Auxiliary contacts shall be rated 10A, 120 VAC.
- C. Fused disconnects and switches shall be provided with integral built-in fuse pullers arranged to facilitate fuse removal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Switches shall be coordinated with the equipment to provide switches to suit the particular equipment characteristics and requirements.
- B. Provide fusible switches for all equipment labeled for and/or requiring fuse protection.

- C. Switches shall be installed in accordance with manufacturer's published instructions.
- D. Provide three (3) spare fuses of each type and rating furnished for this project. Deliver spare fuses to the Owner's place of storage.

3.2 TESTING

- A. Prior to energizing circuits and switches, test wiring for electrical continuity and short-circuits.

END OF SECTION 262816

SECTION 262817 - ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes molded-case circuit breakers in individual enclosures.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches

1.3 SUBMITTALS

- A. Division-01 Section - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

PART 2 - PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKER

- A. Basis of design: Square D. Provide products manufactured by Square D or approved equal by Eaton or General Electric (GE). Equipment shall meet all requirements of this specification and associated drawings for consideration of approved equal.
- B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1 with interrupting capacity to comply with available fault currents.
- C. Accessories: As indicated on Drawings. Conform to NEMA AB 1.
 - 1. Shunt Trip Device
 - 2. Auxiliary Switch
 - 3. Electrical Operator
 - 4. Handle Lock: Provisions for padlocking (NEMA 12 enclosure)
 - 5. Grounding Lug: In each enclosure
- D. Enclosed circuit breakers shall have general purpose, surface mounted, NEMA Type 1, 3R or 4X enclosure as indicated or required by location.
- E. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit breaker frame sizes 250 A and larger.
- F. Service Entrance: Enclosed circuit breakers identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

- G. Circuit breakers shall be fully rated. Series rated withstand are prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosed circuit breakers plumb. Provide supports in accordance with Division-26 Section, "Supporting Devices."
- B. Height: 5 feet (1500 mm) to operating handle.
- C. Locate and install engraved plastic nameplates in accordance with Division-26 Section, "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with National Electrical Testing Association (NETA).

END OF SECTION 262817

SECTION 263600 - AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. This specification describes the requirements associated with the automatic transfer switches and associated control devices as indicated on the drawings and as specified herein. The automatic transfer switches shall be manufactured, installed and tested in strict accordance with these specifications.
- B. Automatic transfer switches associated with fire pumps shall be supplied as an integral part of the fire pump controller. These switches shall be as specified in Division-21.

1.3 SUBMITTALS

- A. Submit the following information for Owner/Engineer review, comments and/or approval:
 - 1. Product data.
 - 2. Complete installation drawings, including plan view and elevations with connection of required utilities clearly indicated.
 - 3. Electrical schematics, wiring diagrams, interconnection diagrams and bussing details.
 - 4. Statement of compliance and deviation as specified herein.
- B. The manufacturer shall submit a copy of these specifications with each sub-paragraph noted with the comment "compliance", "deviation", or "alternate".
 - 1. By noting the term "compliance", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
 - 2. By noting the term "deviation", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
 - 3. By noting the term "alternate", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.
- C. Identify all specified items on submittals to assure compliance and ease of review and/or approval.

1.4 QUALITY ASSURANCE

- A. The automatic transfer switches shall conform to these specifications and applicable codes and standards published by the following authorities and associations:
 - 1. National Fire Protection Association (NFPA)
 - 2. Underwriter Laboratories (UL), UL 1008
 - 3. NFPA 70, National Electrical Code (NEC)
 - 4. American National Standards Institute (ANSI)
 - 5. National Electrical Manufacturers Association (NEMA)

6. American Society of Testing and Materials (ASTM)
7. Institute of Electrical and Electronics Engineers (IEEE)

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

- A. There are two (2) automatic transfer switches required to be provided as part of this project designated as "ATS 3" and "ATS B". Provide 480V, 4 pole, two source delayed transition bypass isolation switches manufactured by ASCO (7000 Series) or approved equal for both switches. ATS B shall be capable of starting and controlling the generator and switching between the normal and generator supply. ATS 3 shall be capable of automatically sensing and selecting between two normal (i.e. non-generator) supplied sources. The below specifications shall be applied as applicable based on the intended sequence of operation of each switch. Refer to the Standby Generator Sequence of Operations located on the Drawings for additional information.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to. ASCO (7000 Series).
- C. The automatic transfer switch shall be factory assembled with the current ratings, voltages and accessories as indicated on the drawings or specified herein.
- D. The switch and all of its associated controls and terminations shall be completely front accessible.
- E. The switch shall be mechanically held in both the normal and the emergency positions, and rated for continuous duty in an unventilated enclosure. The switch shall be open transition, break-before-make, double throw with the main contacts rigidly and mechanically interlocked in both the Normal and Emergency positions.
- F. The automatic transfer switch shall be of the motor or solenoid type. Circuit breaker type switches are not acceptable and will not be considered.
- G. The ATS shall be UL listed, STD UL-1008, with withstand and close-in values which match the overcurrent protective devices for the normal and emergency feeders.
- H. The ATS shall be provided in a NEMA type 1 enclosure suitable for the location where the switch will be installed.
- I. All bus shall be copper.
- J. The ATS shall be four-pole. The four-pole switches shall have ratings identical to the other poles and shall be mounted on the same shaft. Reduced neutral ratings, overlapping neutral contacts and switches which are not true four-pole switches shall not be acceptable.
- K. The ATS shall have a withstand rating equal to the AIC ratings of the circuit breakers from which it is served.

2.2 ACCESSORIES

- A. The ATS shall be provided with the following accessories:
 1. Adj. 0.5-3 second time delay on engine start.

2. Adj. 1-300 second time delay on transfer to emergency.
 3. Adj. 0-30 minute time delay on transfer to normal.
 4. Fixed 5 minute time delay for engine cool-down.
 5. Load test switch, maintained type.
 6. One (1) contact to open and one (1) contact to close on failure of normal to be used for engine starting.
 7. Pilot lights to indicate switch position.
 8. Two (2) auxiliary contacts closed in normal.
 9. Two (2) auxiliary contacts closed in emergency.
 10. Adjustable close differential voltage sensing on all phases of normal, pick-up set at 90%, drop-out set at 85% of nominal.
 11. Voltage and frequency sensing of emergency source, voltage pick-up set at 90%, frequency pick-up set at 95% of nominal.
 12. An automatic seven (7) day exerciser clock, enabling the engine to be automatically started and run without load for thirty (30) minutes each week at a preprogrammed time period. The transfer switch shall remain in the "normal" position unless a commercial power failure occurs during the exercise period.
 13. An additional set of main-shaft auxiliary contacts (1 N.O. and 1 N.C.) and two (2) time delay contacts for connection to the elevator controllers. The time delay contacts shall open twenty (20) seconds (adjustable 1-300 seconds) before transfer in either direction and reclose after transfer is complete.
- B. The ATS shall have an open transition time between the opening of the closed contacts and the closing of the open contacts adjustable from 1-300 seconds.
- C. The ATS shall be equipped with a safe manual operator. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator. The manual operator shall be operable with the ATS door in the closed position.
- D. All relays, timers, control wiring shall be front accessible. All adjustable time delays shall have calibrated marks for field adjustments. Time delay relays/circuits which cannot be accurately set in the field without the use of test equipment are not acceptable.

2.3 OPERATION

- A. Upon loss of normal power and after an adjustable time delay, the switch shall signal the standby generator to start.
- B. The transfer switch shall transfer to emergency when the output of the standby generator reaches 90% of rated voltage and 95% of rated frequency. If the emergency source is not available, or if the generator voltage is less than 90% nominal, transfer to emergency shall be inhibited.
- C. After the normal source has been restored to 90% of rated voltage, the transfer switch shall retransfer to the normal source after an adjustable time period of 0 to 30 minutes.
- D. The standby generator shall continue to run unloaded for five (5) minutes and then shutdown. All controls shall automatically reset in preparation for the next power failure.

2.4 BYPASS-ISOLATION SWITCHES

- A. Provide factory-assembled, manually operated, bypass-isolation switches and all auxiliary equipment required for complete operation.

- B. The bypass-isolation switch shall allow the load to be transferred to either source regardless of the position of the ATS. Positive sequencing of all contacts shall be accomplished using external manual operators.
- C. The bypass-isolation switch shall permit complete testing and maintenance of the ATS. When the switch is in the bypass position, the load shall be connected to the normal or emergency source, and the ATS shall be energized for testing. When the switch is in the isolation position, the load shall be connected to either the normal or the emergency source, and the ATS shall be isolated from all sources of supply for maintenance.
- D. The bypass-isolation switch shall have the same electrical ratings as the ATS with respect to current rating, voltage, frequency, poles, withstand and close-in. The switch shall be of the load break type.
- E. The bypass-isolation switch shall be installed in the same enclosure as the ATS and shall be by the same manufacturer as the ATS.
- F. The bypass-isolation switch shall have the necessary controls to ensure that the engine start contacts remain closed when the load is bypassed to the emergency source.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the automatic transfer switches in the space shown.
- B. Connect auxiliary and control contacts in ATS to the elevator controllers in accordance with the elevator manufacturer's instructions.
- C. Connect auxiliary and control contacts in ATS to the engine-generator control panel in accordance with the engine-generator manufacturer's instructions. For emergency generator applications, control conductors installed between the transfer switch and the generator shall be as follows:
 - 1. Control wire installation shall comply with NEC Article 700.10 (D)(3).
 - 2. The control conductors shall be kept entirely independent of all other wiring and shall meet the conditions of NEC Article 700.10 (D)(1).
 - 3. The integrity of the generator remote start circuit shall be monitored for broken, disconnected, or shorted wires. Loss of integrity shall start the generator(s).
 - 4. The control wiring requirements indicated in 1, 2, and 3 above apply to ATSs within a fire pump controller. Provide control wiring between the fire pump ATS and the generator as required.
- D. Connect auxiliary and control contacts in ATS to the fire alarm annunciators and controls in accordance with the fire alarm instructions.

3.2 TESTING AND CERTIFICATION

- A. Test and demonstrate to the Owner's representative (with factory representative present) that the transfer switch meets the requirements of this specification.
- B. Demonstration shall include, but not be limited to, the operation of all time delays, starting contacts, and transfer functions.
- C. All testing shall be scheduled at the convenience of the Owner, and shall be arranged at least two (2) weeks in advance.

- D. Services shall include a minimum of two (2) visits by representatives of the ATS manufacturer as follows:
1. Following installation, the manufacturer of the ATS shall inspect and verify the correct installation of the ATS. All individual components shall be checked. Power conductors and control circuits shall also be checked.
 2. The manufacturer of the ATS shall provide the services of a qualified technician for initial start-up. Checks and services shall be conducted to prepare equipment for energization.
 3. Field service must be unlimited and must continue until satisfactory system operation and customer approval has been achieved.
 4. Prior to system turnover, an instruction period for operation shall be provided.
- E. Final data sheets, schematics, dimensional drawings, and operating and maintenance instructions shall be provided. This information shall be provided in the operating and maintenance manuals specified in Division-26 Section, Basic Electrical Materials and Methods.

END OF SECTION 263600

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SECTION 264313 - INTEGRATED SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this section.

1.2 SCOPE

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and/or as shown on the contract drawings. To maximize performance and reliability, and to obtain the lowest possible let-through voltages, the AC surge protection is to be integrated into electrical distribution equipment such as switchgear, switchboard, panelboard, busway and/or motor control center, or as shown on the contract drawings.

1.3 REFERENCES

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards
 1. ANSI/UL 1449 4th Edition or later
 2. ANSI/UL 1283 5th Edition or later (Type 2 applications)
 3. IEEE C62.41.1
 4. IEEE C62.41.2
 5. IEEE C62.43-2005
 6. IEEE C62.45-2002
 7. IEEE C62.48-2005
 8. IEEE C62.62-2010
 9. UL 96A
 10. NFPA 780

1.4 SUBMITTALS

- A. Provide verification that the SPD complies with the required ANSI/UL 1449 4th Edition or later listing by Underwriters Laboratories (UL). Compliance may be in the form of a file number that can be verified on UL's website www.ul.org, the website should contain the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current In.
 1. Descriptive bulletins.
 2. Product sheets.
 3. Final record drawings.

1.5 QUALIFICATIONS

- A. The manufacturer of the electrical distribution equipment shall be the manufacturer of the SPD within the listed electrical distribution equipment.

- B. For the equipment specified herein, the manufacturer shall be ISO 14001 and ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of twenty-five (25) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU and have a visible label showing compliance.
- E. The SPD shall be UL 1449 current edition listed, 20 kA In Type 1 or Type 2 for use in UL 96A systems.
- F. The manufacturer must have a 24-hour response capability with field engineering personnel. The field service organization must have fully accredited Power System Engineers located across the USA who are capable of performing complete grounding, Power Quality analysis, and coordination studies. Factory trained SPD sales personnel do not qualify as Power System Engineers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. SPD shall be manufactured by the same manufacturer as the associated panelboard or switchboard.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage: Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode is not acceptable.
4. Unit shall operate without the need for an external overcurrent protection device (OCPD), and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.
5. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (In): All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
7. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR): The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design:

1. Maintenance Free Design: The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform: The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter: Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
 - a. Type 2 units with filtering shall conform to UL 1283 5th Edition.
 - b. Type 1 units shall not contain filtering or have a UL 1283 5th Edition Listing.
4. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics: Each SPD shall provide the following integral monitoring options:
 - a. Protection Status Indicators: Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - 1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
 - 2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes
 - 3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
 - b. Remote Status Monitor (optional) – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
 - c. Audible Alarm and Silence Button (optional) – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
 - d. Surge Counter (optional) – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of $50 \pm 20A$ occurs. A reset

pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

- 1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Thermal MOV Protection:

- a. The unit shall contain thermally protected MOVs. These self-protected MOVs shall have a thermal protection element integrated with the MOV and a mechanical disconnect with arc quenching capabilities in order to achieve overcurrent protection of the MOV. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design: All of the SPD's components and diagnostics shall be contained within one discrete assembly. The use of plug in single-mode modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements:

- a. The SPD shall minimize potential arc flash hazards by containing no single-mode plug in user serviceable / replaceable parts and shall not require periodic maintenance. SPDs containing items such as replaceable single-mode plug in modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.3 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Surge Current Capacity: The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
 - 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 - 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
 - 3. The panelboard shall be capable of re-energizing upon removal of the SPD.
 - 4. The SPD shall be integral to the panelboard and connected directly to the bus. Alternately, an integral SPD can be connected to a circuit breaker for disconnecting purposes, in the case a disconnect is required.
 - 5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 - 6. The SPD shall be of the same manufacturer as the panelboard.
 - 7. The complete panelboard including the SPD shall be UL67 listed.

2.5 SWITCHGEAR, SWITCHBOARD, MCC AND BUSWAY REQUIREMENTS

- A. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
- B. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, or busway
- C. The SPD shall be factory installed integral to the switchgear, switchboard, MCC, and/or bus plug at the assembly plant by the original equipment manufacturer
- D. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
- E. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
- F. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
- G. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 SERVICE ENTRANCE REQUIREMENTS

- A. Service entrance located SPDs shall be tested and designed for applications within ANSI/IEEE C62.41 Category C environments.

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA, IEEE, and UL standards.

3.3 INSTALLATION

- A. The installation of the SPD shall be factory installed integral to the distribution equipment. The Contractor shall install all distribution equipment per the manufacturer's recommendations, applicable electrical codes and the contract drawings.

3.4 WARRANTY

- A. The manufacturer shall provide a ten (10) year warranty (15 year warranty with registration) that covers replacement of the complete unit, including lightning, from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local electrical code.

END OF SECTION 264313

SECTION 264314 - EXTERNAL SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this section.

1.2 SCOPE

- A. The Contractor shall furnish and install the external Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and/or as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be field installed for the indicated low-voltage power distribution equipment.
- B. This section applies to Motorola R56 Type 2A SPD's as shown on the drawings.

1.3 REFERENCES

- A. Qualification Data: Products shall be tested and listed by UL.
 - 1. All SPDs shall be tested and listed by ANSI/UL 1449-2006 (UL 1449 4rd Edition) & Complimentary Listed to UL 1283.
 - 2. In addition to other requirements, SPD's and all components for Motorola R56 Type 2A SPD's shown on the drawings shall be designed, manufactured, and tested in accordance with the latest edition of the Motorola R56 Standards and Guidelines for Communication Sites. These SPD's shall be pre-approved by Motorola in accordance with R56 testing requirements.
- B. Applicable Documents:
 - 1. ANSI/IEEE Std C62.41.1TM-2002, IEEE Guide on the Surge Environment in Low- Voltage (1000 V and Less) AC Power Circuits
 - 2. ANSI/IEEE Std C62.41.2TM-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
 - 3. ANSI/IEEE Std C62.45TM -2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
 - 4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
 - 5. IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment - Clause 8.6.1
 - 6. National Fire Protection Association (NFPA) 70 (N.E.C.) –2014 – Article 285
 - 7. ANSI/UL 1449-2006 Surge Protective Devices
 - 8. IEEE Std C62.72TM-2007 – IEEE Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits

1.4 SUBMITTALS FOR REVIEW

- A. Provide verification that the SPD device complies with required Motorola R56 testing and approval guidelines.

- B. Product Data: For each type of product indicated, include all required testing and pertinent manufacturer information described herein section 1.5, rated capacities, maximum continuous operating voltage, weights and dimensions, electrical characteristics interconnecting wiring requirements, accessories, and ANSI/UL 1449-2006 VPRs.
- C. Warranty duration and replacement policy.
- D. Manufacturer's installation instructions.
- E. Provide a table indicating which panel equipment each SPD will serve. Table shall include project name, panel name, voltage/phase, and SPD model number to be provided, submittals will not be approved without this table.

Panel Name	Volts, Phase	SPD Model Number

1.5 SUBMITTALS FOR INFORMATION

- A. Certificates of Conformity: For SPDs, certifying compliance with UL listing/certification to the following standards:
 - 1. ANSI/UL 1449-2006 (UL 1449 4th Edition)
 - 2. Motorola R56

1.6 SUBMITTALS FOR CLOSEOUT

- A. Operation and Maintenance Data: Closeout Submittal shall include operation, installation and specification data in closeout submittals.
- B. Certification: By Electrical Contractor (Installer) that installation complies with manufacturer's instructions.
- C. Warranty duration and replacement policy.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by UL, and marked for intended location and application.
- B. Manufacturer's Qualifications: Manufacturer must have at least 10 years experience in the engineering, design and manufacture of permanently connected SPDs. Manufacturer operates a Quality System Certified manufacturing facility as ISO 9001:2000 Compliant.

1.8 COORDINATION

- A. Coordinate location of field installed SPDs to allow adequate clearances for maintenance.

1. .

PART 2 - PRODUCTS

2.1 SPDs

- A. Manufacturers: Available Manufacturers: subject to compliance with requirements, provide products by one of the following: Liebert (Basis of Design), Raycap (AC Data), Transtector.
 1. Type 2A SPD tested and pre-approved by Motorola in accordance with Motorola R56 requirements.

2.2 ENCLOSURES

- A. Enclosures: NEMA 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install SPDs in strict accordance with manufacturer's instructions, NEC, and Motorola R56 requirements.
- B. Install SPDs with conductors between SPD and the branch circuit breaker as short and straight as possible. When possible do not exceed manufacturer's recommended lead length. In the case where the lead length exceeds 18 inches the installer must contact the SPD manufacturer for installation assistance.
- C. Install the SPDs immediately adjacent to the switchboard or panelboard being protected.
- D. SPDs must be connected to a dedicated circuit breaker rated for (minimum) 60-amps per manufacturer's installation instructions to ensure a means of disconnecting the SPD from the service without de-energizing the panel or the connected loads. The use of direct bus bar connected SPDs is expressly prohibited and will be rejected.
- E. Do not energize service entrance equipment or panelboards until SPDs are properly installed and connected.
- F. Do not perform insulation resistance tests of the distribution wiring equipment with the SPDs installed. Disconnect all SPDs (all Phase, Neutral and Ground connections) before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.2 FIELD QUALITY CONTROL

- A. Field Service: Electrical Contractor shall inspect, test, and adjust components, assemblies, and equipment installations, including connections to strictly comply with this specification.
 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements and NEC requirements
 2. After installing SPD devices but before electrical circuitry has been energized, test for compliance with requirements.
 3. Complete startup checks according to manufacturer's written instructions, if applicable.

END OF SECTION 264314

SECTION 283111 – FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. There is an existing fire alarm system at this facility. The scope of work for this project includes, but is not limited to the following:
 - 1. Remove existing fire alarm system devices as shown on the drawings.
 - 2. Provide new fire alarm system devices as shown on the drawings.
 - 3. Verify the need for and provide booster panel for proposed notification appliances if required.
 - 4. Modify existing programming at the main fire alarm control panel and remote annunciator as required to include any system modifications resulting from this project.
 - 6. Provide required fire alarm system programming to include any system modifications resulting from this project.
 - 7. Recommission and demonstrate proper operation of the entire fire alarm system for appropriate building personnel and the authority having jurisdiction.
 - 8. All proposed fire alarm system equipment shall be by the existing system manufacturer and compatible with the existing system. The completed system including all existing and proposed equipment shall be a UL listed and labeled assembly.
 - 9. Performance of additional fire alarm system design, shop drawings, calculations, and programming shall be performed by a factory representative. No substitutions permitted. It is the contractor's responsibility to contact this organization and include all associated cost in the bid price.
 - 11. Submit fire alarm system shop drawings and design calculations to the Baltimore County Fire Marshall's Office for approval. Fire alarm system shop drawings and calculations shall be approved by the Baltimore County Fire Marshall before the purchase of any materials or any system installation.
 - 12. Operation and sequences of new devices and fire alarm system shall match that of existing installed equipment unless noted otherwise. Determine operation of existing fire alarm system by means for field survey.
- B. Contractor shall provide and install devices connected to the existing microprocessor based fire alarm and detection system. The system and components shall be the product of a single manufacturer of established reputation and experience. Installation shall include all parts, labor, software and hardware necessary to affect a complete installation.
- C. In addition to the requirements of this section, the electrical and fire alarm contractors shall review the mechanical drawings for quantities and locations of fire alarm devices such as smoke detectors, heat detectors, smoke dampers, etc.

1.2 REQUIREMENTS

- A. The latest editions of the following codes and standards shall govern work performed under this section:
 - 1. Maryland State Fire Prevention Code (COMAR 29.06.01 and 29.06.02)
 - 2. NFPA 101 - Life Safety Code
 - 3. International Building Code (IBC)
 - 4. BOCA National Fire Prevention Code
 - 5. NFPA 70 - National Electrical Code
 - 6. NFPA 72 - National Fire Alarm Code
 - 7. NFPA 80 - Fire Doors and Windows

8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. Americans with Disabilities Act (ADA)
10. International Fire Code (IFC)
11. Baltimore County Fire Prevention Code, County Bill No. 63-13
12. Baltimore County Building Code, Bill No. 40-12

1.3 RELATED SECTIONS

- A. Division-21 Section - Fire Protection.
- B. Division-23 Section - Ductwork Accessories: Smoke dampers.
- C. Division-26 Section - Raceways.
- D. Division-26 Section - Wires and Cables.
- E. Division-26 Section - Boxes, Fittings and Cabinets.

1.4 SYSTEM DESCRIPTION

- A. The existing fire alarm control panel will remain in place and be used as the main fire alarm control panel for this project. The system shall be capable of providing the following functions:
 1. Fire alarm system functions to match existing conditions
- B. Initiating Devices:
 1. Provide analog duct smoke detectors, sampling tube, housing and mounting equipment and connect to system to initiate supervisory signal and shutdown respective air handlers as required by NFPA 90A as noted on the Drawings.
 2. Supply interface monitor modules for automatic sprinkler system waterflow switches and connect to the system to initiate alarm signal.
 3. Supply interface monitor modules for automatic sprinkler system valve tamper switches and pressure switches and connect to system to initiate supervisory signal.
- C. Notification Appliances:
 1. Provide combination speaker/strobe signals as required to ensure audibility and intelligibility of signal as detailed in NFPA 72 as noted on the Drawings.
- D. Auxiliary Functions:
 1. HVAC Shutdown - Shut down respective air handler upon activation of associated duct smoke detector(s).
 2. Door Holders - Release doors automatically upon activation of associated smoke detector(s).
 3. Smoke Dampers - Close respective smoke damper upon activation of associated duct smoke detector(s).
 4. Control module(s) for interconnection between fire alarm system and lighting control system.
- E. Off-Site Supervision: Alarm, supervisory and trouble conditions shall be automatically transmitted to a central station. Provide all relays, equipment and wiring necessary to connect the fire alarm and detection system to a central station. Individual signals shall be transmitted for alarm, supervisory and trouble conditions. NOTE: This function is in place and is existing to remain.

1.5 QUALITY ASSURANCE

- A. The system and all components shall be listed by Underwriters Laboratory for fire protective signaling service (local and remote station, emergency communication and relocation equipment, protective signaling systems) under UL 864. All new system devices and equipment shall be compatible with the existing to remain system. Automatic detectors, manual stations, sprinkler system alarm attachments, control unit accessories, indicating appliances and all other alarm system attachments shall be listed, labeled and approved for use with the specified control equipment. Visual indicating appliances shall be listed and labeled under UL 1971, "Signaling Devices for the Hearing Impaired".
1. Equipment Not Described: The Drawings and Specifications are schematic only and are not intended to relieve the Contractor from responsibility for furnishing all material, equipment and labor required to affect proper system operation. System subassemblies, software, programming, hardware, interface devices, controls, tools, test equipment and related devices vary considerably among manufacturers and cannot be fully described without reducing competition.
 2. Manufacturer/Distributor Support: The Contractor shall confirm to the satisfaction of the Owner that a factory authorized support organization exists within close proximity to the site. Such organization shall be adequately stocked with equipment, parts and accessories, and adequately trained and capable to perform all required engineering, maintenance and testing support necessary to ensure continued efficient and effective system operation.

1.6 SUBMITTALS

- A. Shop drawing and product data approval shall be obtained from the Engineer prior to commencing system installation. Following substantial completion, operations and maintenance data and record drawings shall be submitted to the Owner.
1. Shop drawings shall include a building floor plan indicating the location of all zones, system devices and components, a wiring riser diagram, panel wiring diagram, device wiring details, listing of device addresses, sequence of operation and battery calculations. Drawings shall clearly indicate the height and location of all equipment, devices, wiring, conduit and junction boxes. Drawings shall be clean, neat, professionally prepared by CADD or manual drafting.
 2. Statement of Compliance and Deviation:
 - a. The submittal package shall include a copy of these specifications with each sub-paragraph noted with the comment "Compliance", "deviation", or "alternate".
 - b. By noting the term "compliance", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
 - c. By noting the term "deviation", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
 - d. By noting the term "alternate", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.
 3. Installation Instructions: Manufacturer's installation guide and programming instructions shall be submitted with the shop drawings.
 4. Operations and Maintenance Data: Manufacturer's operating instruction and maintenance manuals, installation instructions and programming guides shall be supplied to Owner and his representatives within fifteen (15) days of substantial completion. Five (5) copies of each manual shall be provided.
 5. Installer's UL Certificate: Provide a copy of the UL certificate or equivalent evidence that the fire alarm contractor is listed by UL or a NRTL for installation and maintenance of "Protective Signaling Systems."

6. System UL Certificate: Provide a letter from the fire alarm system contractor that states the completed system is designed and installed in accordance with the fire alarm system manufacturer's recommendations and is a UL listed and labeled assembly.
7. Record Drawings: All deviations from the approved shop drawings require prior approval of the Engineer. Within fifteen (15) days of substantial completion, record drawings indicating the location and configuration of all equipment, devices, wiring, conduit and junction boxes shall be supplied to the owner. Five (5) copies of each drawing shall be provided. Drawings shall be clean, neat, professionally prepared by CADD or manual drafting.
8. Computer (CADD) files of electrical drawings will not be made available to the Contractor for any purposes.

1.7 SPARE PARTS

- A. Contractor shall supply the Owner with a minimum of one (1) replacement for each ten (10) devices (or fraction thereof) installed of the following devices:
 1. Interface Monitor Modules
 2. Interface Control Modules
 3. Duct Smoke Detector
 4. Speaker/Strobe Signals

1.8 PROGRAMMING AND TEST DEVICES OR TOOLS

- A. Contractor shall furnish all devices necessary to conduct tests of all devices and equipment prior to substantial completion. Upon satisfactory completion of required tests, the contractor shall furnish the owner with two of each device, tool or accessory used and required to perform complete periodic tests and maintenance. Such devices or tools may include interface devices, interface module programming tools, keys, program codes, software and the like. These devices, tools and accessories shall become the property of the Owner.

PART 2 - PRODUCTS

2.1 CONTROL PANEL

- A. The existing fire alarm control panel will remain in place and be used for the main fire alarm control panel for this project. Modify the existing control panel as required to provide the specified operation and components including. The control panel shall provide power, supervision, annunciation and control of all detection and alarm devices. All external circuits shall be inherently power-limited as described in NFPA 70 Article 760. All modules and controls required to provide reliable operation as described in the Drawings and Specifications shall be provided.
- B. All wiring shall be continuously supervised for proper operation. There shall be no unsupervised wiring except for short connections, not to exceed 10 feet (3 m) in length, to motor starters and controls. Abnormal conditions shall be reported at the control unit and remote annunciator within 90 seconds of occurrence.
- C. The removal or disabling of any initiating or notification appliance shall produce a trouble signal. Replacement of any analog initiating device with another device of another type, even with the same address, shall initiate a trouble signal.

- D. Primary power shall consist of a two-wire 120 VAC branch circuit as indicated on the Drawings. The branch circuit disconnect shall be arranged and protected to prevent inadvertent disconnection and ensure optimum reliability.
- E. Activation of any alarm initiating device shall automatically operate all audible and visual appliances and produce an alarm signal at the control unit and at the remote annunciators. Subsequent alarm events shall be continuously stored in the event history log. Alarm signals shall have priority over all other system signals. All alarm signals shall be automatically transmitted to the central station.
- F. Activation of an analog duct detector, sprinkler valve tamper switch, pressure switch, door hold-open smoke detector, standpipe flow switch, or fire pump alarm shall initiate supervisory alarms at the system control panel and at the remote annunciators. Supervisory audible and visible alarms at these locations shall be distinct from either alarm or trouble conditions involving the same or related devices. All supervisory alarms shall be transmitted to the central station.
- G. Open circuits, ground faults, missing detectors, abnormal detector status (e.g.: dirty detector, replacement incompatible with definition), disabled devices, low battery voltage and abnormal control functions shall initiate audible and visible trouble signals at the control unit and remote annunciators. Audible trouble signals shall sound until silenced. Silenced trouble signals shall be continuously indicated by a textual message and a trouble LED until restored to normal operation. The trouble LED shall remain illuminated until all abnormal conditions are cleared. Upon a return to normal operation the audible trouble signal shall resound until restored to normal position. Subsequent trouble events shall resound audible trouble signals until silenced. All trouble events shall automatically be transmitted to the central station.
- H. Access to control unit and remote annunciator switches, wiring and power supplies shall be restricted by keyed-alike locks. Control function and programming access shall be limited by user defined passwords.

2.2 ALARM INITIATING DEVICES

- A. Alarm initiating devices shall consist of addressable detectors and manual stations. These devices shall be listed and approved for use with the control equipment specified.
 - 1. Analog smoke detectors shall be addressable, ionization (or photoelectric where indicated on the Drawings), plug-in type with base. The detector base shall be of the twist/lock type with screw terminals for field wiring. An automatic gain control circuit shall be provided to compensate for detector aging and dirt accumulation and maintain the detector within the correct sensitivity range. A critical reduction of sensitivity caused by dirt accumulation shall initiate a trouble signal. Detector sensitivity shall be capable of being read and adjusted from the control panel.
 - 2. Provide flush anti-ligature type smoke detector in patient rooms.
 - 3. Interface monitor and control modules shall be addressable, mounted in standard 4" x 4" (100 mm x 100 mm) square or octagonal electrical boxes with covers. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamp shall be visible in the cover. These modules are to be used for connection of conventional alarm devices such as waterflow switches, valve tamper switches, fire pump alarms and other non-addressable devices. Connections between devices and modules shall be integrally supervised for open and ground faults. Monitor and control functions may be integrated in a single interface module if listed and approved for this purpose.
 - 4. Duct type detector assemblies shall consist of an addressable analog photoelectric detector, an air duct sampling tube and detector housing. Provide a remote test station with alarm indicating lamp for all duct detectors installed in concealed spaces.
 - 5. Manual stations shall be addressable, red in color, non-coded, double-action, non-break glass type. Manual station covers shall be hinged and secured with a lockset. Lockset shall be keyed the same as the control unit lockset.

6. Heat detectors shall be addressable, plug-in type with base. The detector base shall be of the twist lock type with screw terminals for field wiring. Detectors shall be rate-compensation, fixed temperature type, rated at 135 °F (57°C). Detector element shall be self-restoring after operation.

2.3 NOTIFICATION APPLIANCES

- A. Strobes shall provide a minimum effective intensity of candela levels listed on the contract drawings. Strobes shall be listed to 1971 Standard Underwriter Laboratories.
- B. Provide clear strobes in locations shown on the drawings connected to the fire alarm system for fire alarm function with "Fire" on the bezel plate.
- D. Provide speakers in locations shown on the drawings. Speaker devices shall be separate from strobe devices.

2.4 AUXILIARY DEVICES

- A. Interface control modules shall be addressable, mounted in standard 4" x 4" (100 mm x 100 mm) square or octagonal electrical boxes with covers. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamp shall be visible in the cover. These modules are used for control of auxiliary functions such as elevator recall, fan shutdown, and door holder release. Interface modules shall be equipped with form "C" dry-contacts rated 2A, 125 VAC or 2A, 30 VDC resistive. Monitor and control functions may be integrated in a single interface module if listed and approved for this purpose.

2.5 ANNUNCIATOR PANELS

- A. Modify the existing programming at the main fire alarm control panel and remote annunciator as required to include any system modifications resulting from this project.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division-16 Section, Basic Electrical Materials and Methods for general execution requirements.
- B. Smoke detectors shown on the Drawings indicate areas where smoke detectors shall be installed. The location and quantity of smoke detectors shall be in accordance with NFPA 72 and the UL Listing for the specific devices.
- C. Heat detectors shown on the Drawings indicate areas where heat detectors shall be installed. The location and quantity of heat detectors shall be in accordance with NFPA 72 and the UL Listing for the specific devices.
- D. Duct smoke detectors shall be installed in accordance with manufacturer's written instructions. Detectors shall be readily accessible for cleaning and testing. Provide access panels or doors if necessary. Provide duct detectors on both the supply and return of all air handling units provided under this contract unless otherwise noted.
- E. Interface modules (monitor and control) shall be located within 3 feet (75 mm) of the device it is monitoring or controlling.

- F. Strobes shall be installed with the bottom of the appliance 80 inches (2000 mm) above the finished floor or 6 inches (150 mm) below the finished ceiling, whichever is lower.
- G. Manual stations shall be installed with the top of the device 48 inches (1200 mm) above the finished floor.

3.2 QUALIFICATIONS

- A. The performance of all additional fire alarm system design, shop drawings, calculations, and programming shall be performed by a factory authorized representative.

3.3 CHANGES

- A. The technician supervising field work shall promptly notify the engineer of any changes or deviations from the contract drawings and specifications necessitated by field conditions.

3.4 WIRING

- A. All field wiring shall be installed in conduit. Conduit and boxes shall be sized according to National Electrical Code requirements based on the number of conductors. Initiating device circuit wiring shall be two-conductor twisted with integral shield and ground. Indicating appliance circuits shall be minimum 14 AWG. Primary power (AC) branch circuit conductors shall be minimum 12 AWG. Address loop circuits shall be a minimum of 18 AWG.
- B. All concealed fire alarm conduit located in stairwells, storage rooms, mechanical rooms, garages, and utility rooms shall be painted red enamel. All other exposed fire alarm conduit (outside the stairwells) shall be painted to match the existing adjacent wall surface, and red enamel bands 0.10 m wide shall be painted at 3.0 m intervals. The painting requirement also applies to the pull boxes, junction boxes, mounting boxes and extensions. Red enamel bands shall not be painted on the pull boxes, junction boxes, mounting boxes, and extensions.
- C. All speaker circuits shall be in separate, dedicated conduit.
- D. All strobe circuits shall be in separate dedicated conduit. Amber and clear strobe circuits shall be in the same conduit.
- E. All conduit shall be ¾" EMT red in color.
- F. Fire alarm circuits shall be identified by red junction box covers stenciled in white letters "FIRE ALARM."
- G. Fire alarm wiring shall be color coded in accordance with requirements of local Authority Having Jurisdiction.
- H. The addressable loop shall be wired Class B, Style 4. The initiating devices shall be wired Class B, Style B. The notification appliances shall be wired Class B, Style Y. Where transponder panels are required, wiring from control panel through the transponder panels shall be Class A, Style 6.
- I. All wiring shall be tested for the following conditions before devices are installed or circuits connected to control equipment:
 - 1. Verify that stray (unwanted) voltages do not exist between the installation conductors and ground or between conductors.

2. Verify all conductors not intentionally grounded are isolated from ground using an approved insulation testing device or "megger."
 3. Verify that all conductors not intentionally connected together are isolated from one another using an approved insulation testing device or "megger."
 4. Measure and record the loop resistance of each circuit with the conductor pair shorted together at the far end, verify that loop resistance does not exceed manufacturer's requirements.
- J. Supply the Owner and Engineer with a copy of all circuit testing reports and loop resistance readings.

3.5 SYSTEM TESTING

- A. Owner Testing: All initiating and indicating appliances, control equipment, accessories and auxiliary functions shall be tested in accordance with NFPA 72 acceptance test procedures for the Owner prior to the Fire Marshall testing. Representatives of the Owner and Engineer shall be notified of the date and time of the test. A minimum of fourteen (14) days notice is required when scheduling the acceptance test. The Contractor is responsible for conducting all required tests. All necessary equipment and supplies shall be provided at Contractor's expense, including ladders, radios, test equipment, volt-ohm meter, sound-pressure (decibel) meter, flashlights, hand tools and smoke or smoke substitute for functional tests. All test procedures shall conform to the manufacturer's recommended test procedures and the NFPA 72 recommended practice. Subcontractors responsible for related work connected to or controlled by the fire detection and alarm system shall be available to demonstrate their equipment at the time of acceptance testing. The completed system shall be tested and accepted by the Owner before scheduling the Fire Marshall's test.
- B. Fire Marshall Testing: The completed system shall be tested and accepted by the Owner before scheduling the Fire Marshall test. All initiating and indicating appliances, control equipment, accessories and auxiliary functions shall be tested in accordance with NFPA 72 acceptance test procedures. Representatives of the Owner, Engineer and local Fire Marshall shall be notified of the date and time of the test. A minimum of fourteen (14) days notice is required when scheduling the acceptance test. The Contractor is responsible for conducting all required tests. All necessary equipment and supplies shall be provided at Contractor's expense, including ladders, radios, test equipment, volt-ohm meter, sound-pressure (decibel) meter, flashlights, hand tools and smoke or smoke substitute for functional tests. All test procedures shall conform to the manufacturer's recommended test procedures and the NFPA 72 recommended practice. Subcontractors responsible for related work connected to or controlled by the fire detection and alarm system shall be available to demonstrate their equipment at the time of acceptance testing.

3.6 TEST REPORT

- A. The Contractor shall prepare and submit a test report in the form and content required by NFPA 72. The report shall be signed by the supervising technician or fire protection engineer. The Contractor shall submit the report to the Owner and his representatives, upon completion of testing.

3.7 WARRANTY

- A. The completed system shall be warranted for a period of two (2) years from the date of acceptance. The warranty shall cover all defects in parts and workmanship, and expenses related to parts, labor and travel to and from the site for the purposes of correcting same. Maintenance and repair shall be performed only by a factory trained service technician.

3.8 TRAINING

- A. Contractor shall arrange and furnish training for Owner's representatives. This training shall include instruction in proper system maintenance, test and troubleshooting procedures. Provide a minimum of eight (8) hours of training.

END OF SECTION 283111

SPECIAL PROVISIONS

Builder's Risk Insurance

- A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County against loss of damage covered by an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.
- B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

S E C T I O N I I I

Permits

N/A

SECTION I V

Proposal

**This Section to be
Completed by Time of Bid**

SECTION-IV
PROPOSAL

DESCRIPTION OF WORK

Bid Opening via Teleconference WebEx: Thursday, July 10, 2025 @ 10:30 a.m. EST.

WebEx Phone Number 1-415-655-0001, Access Code Number 2312 820 4572##.

Begin Work Within Fifteen (15) Days After NOTICE TO PROCEED

Calendar Days for Completion: Two Hundred Forty-One (241)

Liquidated and Other Damages: FIFTEEN HUNDRED DOLLARS (\$1500.00 PER CALENDAR DAY)

Cost Group "E" (\$2,500,001 to \$5,000,000) (Prequalified contractors with a Cost Group restriction must bid within the dollar amount stated on their Certificate of Prequalification)

Work Classification: I4

TO BALTIMORE COUNTY, MARYLAND: Furnish & install all appurtenances, labor and materials for the 911 Center UPS Replacement. **Towson - District 9c6.**

The following listed Drawing Number(s) are collectively the "Drawings", and are hereby incorporated in the Contract.

<u>Workday Number</u>	<u>Drawing Number(s)</u>
10001155	2025-1360 thru 1419

A pre-bid meeting will be held on Wednesday, June 18, 2025 at 10:00 a.m. EST via WebEx. *Phone-In (Audio Only)* – 1-415-655-0001, Meeting Number 2300 812 2718##. *Video Conference* – Meeting Number 2300 812 2718 ,**Password: n2eGz8K6m3P**, go to <https://signin.webex.com/join>, or for the WebEx link go to www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

NOTE: No successful bidder may withdraw their bid within NINETY (90) days after the opening thereof.

The Contractor hereby declares that it has carefully examined the solicitation, plans and specifications, form of contract, Special Provisions and Drawings (collectively the "Contract Documents"). The Contractor also hereby declares that it has carefully examined the September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction", collectively the "Applicable County Law" and any and all Department of Public Works and Transportation revisions thereto as of the date of advertisement. The Contract Documents, the Applicable County Law and the Department of Public Works and Transportation revisions thereto are collectively the "Specifications" and are incorporated herein. Copies of any and all Department of Public Works and Transportation revisions including but not limited to the General Conditions Building Projects, are available online at www.baltimorecountymd.gov/departments/public-works/standards. Also, the Contractor has, to its satisfaction, examined the locality of the proposed work and agrees to furnish all labor, tools, materials, machinery, equipment, and other means of construction called for in the manner provided in the Specifications for the prices shown on the next page(s) and as evidenced by Contractor's signature on the last page thereof.

SCHEDULE OF PRICES

NOTE: The Bidder shall fill out this Proposal, write in the unit prices in clear numerals, and make the extensions.

For complete information concerning these items, see Specifications and contract forms.

CONTRACT PROPOSAL

911 Center UPS Replacement, Circuit Courts Building - 401 Bosley Avenue, Towson, Maryland 21204

CONTRACT NUMBER: 25030 PO0

WORKDAY NUMBER: 10001155

JOB ORDER NUMBER: N/A

CALENDAR DAYS: 241

CONTRACTOR: _____
ADDRESS: _____
PHONE: _____

BID ITEM	COMM. CODE		DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	0	0000	911 CENTER UPS REPLACEMENT CIRCUIT COURTS BUILDING	LS	1		\$
TOTAL COST FOR CONTRACT							\$

TOTAL COST FOR CONTRACT IN WORDS

OFFICER SIGNATURE

TITLE

PROPOSAL AFFIDAVIT

1. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____ and the duly authorized representative of [business]_____ (the "Business") and that I possess the legal authority to make this Affidavit on behalf of myself and the Business for which I am acting.

2. PROPOSAL CERTIFICATION

THE UNDERSIGNED HEREBY ACKNOWLEDGES receipt of the following Addenda (list by number and date):

Accompanying this Proposal is a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid, if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment to Baltimore County of the amount thus determined as liquidated damages in case of default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award.

3. AFFIRMATION REGARDING BRIBERY CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies (as is defined in Section 16-101(f) of the State Finance and Procurement Article of the Annotated Code of Maryland), has been convicted of, or has had probation before judgment imposed pursuant to Section 6-225 of the Criminal Procedure Article of the Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows [indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the Business]:

4. AFFIRMATION REGARDING OTHER CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies, has:

(1) Been convicted under state or federal statute of a criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract, fraud, embezzlement, theft, forgery, falsification or destruction of records, or receiving stolen property;

(2) Been convicted of any criminal violation of a state or federal antitrust statute;

(3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. §1961, et seq., or the Mail Fraud Act, 18 U.S.C. §1341, et seq., for acts arising out of the submission of bids or proposals for a public or private contract;

(4) Been convicted of a violation of the State Minority Business Enterprise Law, Section 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(5) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsection (1), (2), (3), or (4) above;

(6) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of bids or proposals for a public or private contract;

(7) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described above, except as follows [indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the Business, and the status of any debarment]:

5. AFFIRMATION REGARDING DEBARMENT

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows [list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceeding, the name(s) of the person(s) involved and their current positions and responsibilities with the Business, the grounds of the debarment or suspension, and the details of each person's involvement in any activity that formed the grounds of the debarment or suspension]:

6. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES

I FURTHER AFFIRM THAT:

(1) The Business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The Business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows: [you must indicate the reasons why the affirmations cannot be given without qualification]:

7. SUB-CONTRACT AFFIRMATION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

8. AFFIRMATION REGARDING COLLUSION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, members or partners, nor any of its employees, have in any way:

(1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying bid or offer that is being submitted;

(2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the bid price or price proposal of the bidder or offeror or of any competitor, or otherwise take any action in restraint of free competitive bidding in connection with the contract for which the accompanying bid or offer is submitted;

(3) Colluded with anyone to obtain information concerning the bid that would give the Business an unfair advantage over others.

9. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

The Business affirms that it is aware of, and will comply with, the provisions of Sections 14- 101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, which require that every person who makes, during any 12-month period, one or more contracts, with one or more Maryland governmental entities involving cumulative consideration, or at least \$200,000.00, shall file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of \$500 during defined reporting periods.

10. CERTIFICATION OF CORPORATION REGISTRATION AND TAX PAYMENT

I FURTHER AFFIRM THAT:

(1) The Business is a _____(State) (Corporation), (LLC), (Partnership), (Sole Proprietor/Individual), (Other:_____), that it **is** registered in accordance with the Corporations and Associations Article of the Annotated Code of Maryland, that it **is** in good standing in the State of Maryland, and that it **has** filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation, and that the name and address of its resident agent filed with the State Department of Assessments and Taxation is:

Name: _____

Address: _____

(If none, so state)

(2) Except as validly contested, the Business has paid, or has arranged for payment of, all taxes due the State of Maryland and Baltimore County, and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, and the Employment Security Administration, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

11. CONTINGENT FEES

I FURTHER AFFIRM THAT:

The Business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Business, to solicit or secure the Contract, and that the Business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or other consideration contingent on the making of the Contract.

12. NONDISCRIMINATION IN EMPLOYMENT STATEMENT

I FURTHER AFFIRM THAT:

During the performance of any contract awarded of which this affidavit is a part:

(1) The Business will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test. The Business will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test. Such action shall include, but not be limited to the following: employment, promotion, upgrading, demotion or transfer, rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Business agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the owner setting forth provisions of this nondiscrimination clause.

(2) The Business will, in all solicitations or advertisements for employees placed by or on behalf of the Business, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test.

(3) The Business shall send to each labor union or representative of workers with which the Business has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the owner, advising the said labor union or workers' representative of these commitments, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Business shall furnish, if requested by the County, a compliance report concerning our employment practices and policies in order for the County to ascertain compliance with the special provisions of this affidavit concerning nondiscrimination in employment.

(5) In the event of the Business's noncompliance with the nondiscrimination clause of this affidavit, the contract may be canceled, terminated, or suspended in whole or in part, and the Business may be declared ineligible for further County work.

(6) The Business shall include the special provisions outlined herein pertaining to nondiscrimination in employment in every subcontract, so that such nondiscrimination in employment provisions shall be binding on each subcontractor or vendor.

13. FOREIGN CONTRACTS

I FURTHER AFFIRM THAT:

The Business affirms that it is aware of, and will comply with, the provisions of Sections 10-2-110 Article 10. Finance, Title 2 – Purchasing, Baltimore County Code 2003, which requires that prior to the award of a contract for services under the provisions of this title, and during the entire term of a contract award, the bidder or vendor shall disclose to the County whether any services covered by the bid or contract, including any subcontracted services, will be performed outside the United States. The disclosure shall be made to the Office of Budget and Finance, Purchasing Bureau.

14. MINORITY BUSINESS ENTERPRISE AND FEMALE CONTRACTORS

THIS BUSINESS INTENDS to affirmatively seek out and consider minority business enterprises to participate in this contract as subcontractors and/or suppliers of materials and services.

THE UNDERSIGNED UNDERSTANDS AND AGREES: that any and all subcontracting of supplies and services in connection with this contract, whether undertaken before or after award of contract, will be in accordance with the Minority Business Enterprise and Female Contractor requirement included in the Bid Proposal package and incorporated herein as if fully set forth; and

THE UNDERSIGNED ALSO UNDERSTANDS AND AGREES that no subcontracting will be approved until Baltimore County has reviewed and approved the affirmative actions taken by this firm.

15. REQUIREMENTS FOR EXECUTING AFFIDAVIT & PROPOSAL

The Affidavit must be signed in ink in order for the bid to be accepted and that the Proposal must be typewritten or filled out in ink.

THE UNDERSIGNED ALSO UNDERSTANDS that:

Proposals submitted by an INDIVIDUAL must be signed by an individual.

Proposals submitted by a PARTNERSHIP must be signed by the partner who is legally authorized authority to bind the partnership. Attach a copy of the Partnership Agreement and a duly certified resolution evidencing the authority of the partner so signing on behalf of the partnership.

Proposals submitted by a CORPORATION must be signed by a legally authorized officer of the corporation and attested to by the Corporate Secretary. Attach a copy of the Articles of Incorporation, By-Laws and a duly certified Board Resolution evidencing the authority of the officer so signing on behalf of the corporation.

Proposals submitted by a LIMITED LIABILITY COMPANY must be signed by a legally authorized member of the company and attested to. Attach a copy of the Operating Agreement, Articles of Organization and a duly certified resolution evidencing the authority of the member so signing on behalf of the limited liability company.

NOTE: The contractor may file with the County a list of the names of those officers, partners or members, as applicable, having legal authority to execute documents on behalf of and legally bind the contractor, duly certified, as applicable and legally required, together with the aforesaid corporate documents, which shall remain in full force and effect until such time as the County Department of Public Works and Transportation, Construction Contract Administration is advised in writing to the contrary.

16. ACKNOWLEDGMENT

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the County and may be distributed to units of (1) Baltimore County; (2) the State of Maryland; (3) other counties or political subdivisions of the State of Maryland; (4) other states; and (5) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this bid or proposal shall be construed to supersede, amend, modify or waive, on behalf of Baltimore County, or the State of Maryland or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the Business with respect to (a) this Affidavit, (b) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

WITNESS/ATTEST:

_____	By: _____
Date: _____	Name: _____
	Title: _____
	(Authorized Representative and Affiant)

BID BOND

Principal

Business Address of Principal

Surety

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

Five Percent of Bid Amount \$ _____ 5% of Bid

Penal Sum of Bond [shall be determined pursuant to latest revised Specification / G.P. 2.07 (2000 Ed.)]

911 Center UPS Replacement Circuit Courts Building
Contract Name

25030 PO0
Contract Number/Proposal Item Number

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal, above named, and Surety, above named, and authorized to do business in the State of Maryland, are held and firmly bound unto the Obligee, above named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that if the aforesaid Principal is the apparent low bidder and complies with all specified matters required before award or if the aforesaid Principal is awarded the contract, the said Principal will, within the time required, execute and deliver to the Obligee a formal contract and good and sufficient payment and performance bonds in the form provided by the Obligee, then, this obligation to be void; otherwise the Principal and Surety will, upon demand, pay unto the Obligee the entire Penal Sum of this Bid Bond as liquidated damages.

THE SURETY FURTHER GUARANTEES No Proposal will be considered unless accompanied by a guaranty of the amount specified in the Proposal in the form of either a certified check, bank cashier's check or a Bid Bond on the form provided therein or an exact facsimile thereof. The Bid Bond must be executed by a Surety that is, as of the date of the Bid: (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. The Bid Bond must guaranty payment to the County of liquidated damages as follows: (a) if only one Bid is received, the guaranteed payment shall be five (5%) percent of the Bidder's Bid amount, (b) if two or more Bids are received, the guaranteed payment shall be the difference between the Bidder's Bid amount and the next lowest Bid amount, subject to the limitation that the guaranteed payment not be greater than five (5%) percent of the Bidder's Bid amount. This Bid Bond is required in case the successful Bidder, after issuance of notice of Award, fails to comply, timely and completely, with each of the requirements set forth under Section GP-3.04.

Signed and sealed _____
Date

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

Individual Principal

Witness: _____

as to: _____ (SEAL)

Print Name: _____

Print Name: _____

Corporate Principal

In Presence of:

(Name of Corporation)

Witness: _____

By: _____

Print Name: _____

Print Name: _____ (SEAL)

Title: _____

Surety

(Name of Surety)

Business Address: _____

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal



First Source Hiring Agreement Overview

What is First Source Hiring?

Baltimore County's First Source Hiring Agreement requires that developers, contractors, and employers utilize good faith efforts toward employing economically disadvantaged Baltimore County residents in newly created positions on applicable projects. These efforts are supported by Baltimore County's workforce development system, a partnered network of business and economic development professionals, education and training providers, and human service agencies working together systematically to provide a ready supply of qualified workers to employers with hiring needs. The intent of First Source is to connect these individuals with new jobs that are generated by the County's investment in contracts or public works; or by business activity that requires approval by the County's Department of Economic and Workforce Development.

The goals of the First Source Hiring Agreement are to:

- Increase awareness of the resources, services and potential benefits available to help Baltimore County employers meet their workforce needs; and,
- Give economically disadvantaged individuals the first opportunity to apply for new jobs in Baltimore County.

Which businesses can participate in First Source Hiring?

1. Businesses who have leases with the County or on County property; or,
2. Businesses with County contracts for goods, services, and grants under \$300,000 which are projected to create new jobs/positions to fulfill contract terms

How can first source help your business?

Baltimore County Department of Economic & Workforce Development's (DEWD's) Business Services Team can help coordinate recruitment services with our workforce partners in collaboration with our three Baltimore County Career Center locations to assist with finding pre-screened, qualified candidates.

Available services may include but are not limited to:

- Posting and promotion of employment opportunities through our network of service providers
- Access to diverse talent pools from within Baltimore County's workforce system
- Access to Baltimore County Career Centers for coordinated recruitment/interviewing activities
- Referral of pre-screened, qualified candidates for employer consideration
- Assistance with using the Maryland Workforce Exchange - a statewide job database and candidate matching platform
- Information on earning tax credits and other employer benefits for new hires (if applicable)
- Workforce and Business Services staff to assist you throughout your recruitment efforts

I'd like to participate in First Source Hiring...Where do I start?

Step #1: Register your business with the [Maryland Workforce Exchange](#). This is an online database to track First Source Hiring job opportunities. As an employer, the Maryland Workforce Exchange can help you promote job openings, search for qualified candidates and share placement information.

Step #2: Businesses or non-profits who receive a non-construction or professional services contract from Baltimore County under \$300,000 are required to project the number of job openings they expect during the contract period. After registering your business with [Maryland Workforce Exchange](#), complete the **First Source Hiring Description Form** and email it to the Baltimore County Department of Economic and Workforce Development (DEWD) at firstsourcehire@baltimorecountymd.gov. If you have any questions about registering with MWE or completing the form, contact our office at 410-887-8000.

Step #3: Once you are registered in MWE and Baltimore County receives your **First Source Hiring Description Form** via email, you will be contacted by a member of the Business Development Team to assist with recruitment for your open positions.

Helpful Tips:

Businesses that qualify are asked to post their openings with Baltimore County's First Source Hiring network of service providers, and offer the County the first opportunity to refer qualified candidates to those positions. While the agreement does not require an employer to hire a specific candidate, it does ask that employers make a good faith effort to hire referrals from the County's workforce development system. We ask that employers would report basic information for any new hires by entering the placement data in the Maryland Workforce Exchange, or by completing an Employment Verification and Employer Survey Form (see FORM 2 attached) or via email at the completion of your recruitment activities.

Company Name

Contact Name

Company Address

City, MD

E-mail Address

Telephone

Acknowledgment Signature

Date

STATE OF MARYLAND
DEPARTMENT OF LABOR
DIVISION OF LABOR AND INDUSTRY
PREVAILING WAGE SECTION
1100 N. Eutaw Street, Room 607
Baltimore, MD 21201
(410) 767-2342

05/13/2025

REQUEST FOR ADVERTISEMENT AND NOTICE TO PROCEED

Heather Panowicz - Procurement Officer
Dept of Public Works and Transportation
111 West Chesapeake Ave Room 300B
Towson, MD 21204

Re: 911 UPS Upgrades Courts Building
Project No: 25030 POO

Enclosed please find the Prevailing Wage Determination and Instructions for Contractors for the project referenced above.

Upon advertisement for bid or proposal of this project, you are requested to submit to this office the date and name of publication in which such advertisement appeared.

Once awarded, you are further directed to submit to this office, the NOTICE TO PROCEED for the project, complete with the date of notice, the name of the general contractor, and the dollar amount of the project. In addition, we ask that a representative of the prevailing wage Unit be invited to attend the Pre-Construction Conference.

Any questions concerning this matter may be referred to PrevailingWage@dllr.state.md.us

Sincerely,

Enclosures
Wage Determination
Instruction for the Contractor

Prevailing Wage Unit

PREVAILING WAGE INSTRUCTIONS FOR THE CONTRACTOR & SUBCONTRACTOR

The contractor shall electronically submit completed copies of certified payroll records to the Commissioner of Labor & Industry, Prevailing Wage Unit by going on-line to <https://www.dlir.state.md.us/prevwage> and following the instructions for submitting payroll information (NOTE: A contractor must register prior to submitting on-line certified payroll information).

If you have technical questions regarding electronic submittal, contact the Department at dldlirprevailingwage-dlir@maryland.gov.

All certified payroll records shall have an accurate week beginning and ending date. The contractor shall be responsible for certifying and submitting to the Commissioner of Labor and Industry, Prevailing Wage Unit all of their subcontractors' payroll records covering work performed directly at the work site. By certifying the payroll records, the contractor is attesting to the fact that the wage rates contained in the payroll records are not less than those established by the Commissioner as set forth in the contract, the classification set forth for each worker or apprentice conforms with the work performed, and the contractor or subcontractor has complied with the provisions of the law.

A contractor or subcontractor may make deductions that are (1) required by law; (2) required by a collective bargaining agreement between a bona fide labor organization and the contractor or subcontractor; or (3) contained in a written agreement between an employee and an employer undertaken at the beginning of employment, if the agreement is submitted by the employer to the public body awarding the public work and is approved by the public body as fair and reasonable.

A contractor or subcontractor is required to submit information on-line on their fringe benefit packages including a list of fringe benefits for each craft employed by the contractor or subcontractor, by benefit and hourly amount. Where fringe benefits are paid in cash to the employee or to an approved plan, fund, or program, the contribution is required to be indicated.

Payroll records must be electronically submitted and received within 14 calendar days after the end of each payroll period. If the contractor is delinquent in submitting payroll records, processing of partial payment estimates may be held in abeyance pending receipt of the records. In addition, if the contractor is delinquent in submitting the payroll records, the contractor shall be liable to the contracting public body for liquidated damages. The liquidated damages are \$10.00 for each calendar day the records are late.

Only apprentices registered with the Maryland Apprenticeship and Training Council shall be employed on prevailing wage projects. Apprentices shall be paid a percentage of the determined journey person's wage for the specific craft.

Overtime rates shall be paid by the contractor and any subcontractors under its contracts and agreements with their employees which in no event shall be less than time and one-half the prevailing hourly rate of wages for all hours worked in excess of ten (10) hours in any one calendar day; in excess of forty (40) hours per workweek; and work performed on Sundays and legal holidays.

Contractors and subcontractors employing a classification of worker for which a wage rate was not issued SHALL notify the Commissioner of Labor & Industry, Prevailing Wage Unit, for the purpose of obtaining the wage rate for said classification PRIOR TO BEING EMPLOYED on the project. To obtain a prevailing wage rate which was NOT listed on the Wage Determination, a contractor or subcontractor can look on the LABOR webpage under prevailing wage.

Contractors and subcontractors shall maintain a valid copy of proper State and county licenses that permit the contractor and a subcontractor to perform construction work in the State of Maryland. These licenses must be retained at the worksite and available for review upon request by the Commissioner of Labor and Industry's designee.

****Each contractor under a public work contract subject to Section 17-219 shall:**

1. Post a clearly legible statement of each prevailing wage rate to be paid under the public work contract; and
2. Keep the statement posted during the full time that any employee is employed on the public work contract.
3. The statement of prevailing wage rates shall be posted in a prominent and easily accessible place at the site of the public work.

****Penalty - Subject to Section 10-1001 of the State Government Article, the Commissioner may impose on a person that violates this section a civil penalty of up to \$50.00 per violation.**

Under the Maryland Apprenticeship and Training Council requirements, consistent with proper supervision, training and continuity of employment and applicable provisions in collective bargaining agreements, a ratio of one journey person regularly employed to one apprentice shall be allowed. No deviation from this ratio shall be permitted without prior written approval from the Maryland Apprenticeship and Training Council.

Laborers may NOT assist mechanics in the performance of the mechanic's work, NOR USE TOOLS peculiar to established trades.

ALL contractors and subcontractors shall employ only competent workers and apprentices and may NOT employ any individual classified as a HELPER or TRAINEE on a prevailing wage project.

The State Apprenticeship and Training Fund (Fund) law provides that contractors and certain subcontractors performing work on certain public work contracts are required to make contributions toward apprenticeship. See §17-601 through 17-606, State Finance and Procurement, Annotated Code of Maryland. Contractors and subcontractors have three options where they can choose to make their contributions: (1) participate in a registered apprenticeship training program; (2) contribute to an organization that has a registered apprenticeship training program; or (3) contribute to the State Apprenticeship and Training Fund.

The Department of Labor (LABOR) is moving forward with final adoption of regulations. The regulations were published in the December 14, 2012 edition of the Maryland Register.

IMPORTANT: Please note that the obligations under this law will become effective on JULY 1, 2013. This law will require that contractors and certain subcontractors make contributions toward apprenticeship and report those contributions on their certified payroll records that they submit pursuant to the prevailing wage law.

The Department is offering outreach seminars to any interested parties including contractors, trade associations, and any other stakeholders. Please contact the Department at dldlprevailingwage-dllr@maryland.gov or (410) 767-2968 for seminar times and locations. In addition, information regarding this law will be provided at pre-construction meetings for projects covered by the Prevailing Wage law.

For additional information, contact:
Division of Labor and Industry
Maryland Apprenticeship and Training
1100 North Eutaw Street, Room 606
Baltimore, Maryland 21201
(410) 767-2246
E-Mail Address: matp@dllr.state.md.us.

STATE OF MARYLAND
DEPARTMENT OF LABOR
DIVISION OF LABOR AND INDUSTRY
PREVAILING WAGE SECTION
1100 N. Eutaw Street, Room 607
Baltimore, MD 21201
(410) 767-2342

The wage rates to be paid laborers and mechanics for the locality described below is announced by order of Commissioner of Labor and Industry.

It is mandatory upon the successful bidder and any subcontractor under him, to pay not less than the specific rates to all workers employed by them in executing contracts in this locality. Reference: Annotated Code of Maryland State Finance and Procurement, Section 17-201 thru 17-226.

These wage rates were taken from the locality survey of 2024 for Baltimore County, issued pursuant to the Commissioner's authority under State Finance and Procurement Article Section 17-209, Annotated Code of Maryland or subsequent modification.

****Note:** If additional Prevailing Wage Rates are needed for this project beyond those listed below, contact the Prevailing Wage Unit. Phone: (410) 767-2342, email: prevailingwage@dlr.state.md.us.

Name and Title of Requesting Officer: Heather Panowicz - Procurement Officer
Department, Agency or Bureau: Dept of Public Works and Transportation
111 West Chesapeake Ave Room 300B Towson, MD 21204

Project Number
25030 PO0

Location and Description of work:

Determination Number
61872

Baltimore County: Installation of a new, redundant UPS System for the 911 Call Center in Towson. This is to ensure that the 911 call Center can continue to operate in a power outage and if the current UPS System fails during that outage.

Date of Issue: May 13, 2025

BUILDING CONSTRUCTION

CLASSIFICATION	MODIFICATION REASON	BASIC HOURLY RATE	BORROWED FROM	FRINGE BENEFIT PAYMENT
BALANCING TECHNICIAN	CR	\$47.92		\$24.44
BRICKLAYER	CR	\$37.50		\$14.78
CARPENTER	CR	\$34.41		\$14.49
CARPENTER - SHORING SCAFFOLD BUILDER	CR	\$34.41		\$14.49
CARPET LAYER	CR	\$34.12		\$14.86
CEMENT MASON	SR	\$25.00	005	\$1.94
COMMUNICATION INSTALLER TECHNICIAN	SR	\$36.37	005	\$12.89
DRYWALL - SPACKLING, TAPING, & FINISHING	CR	\$34.41		\$14.49
ELECTRICIAN	CR	\$47.13		\$21.94
ELEVATOR MECHANIC	CR	\$56.36		\$45.50
FIRESTOPPER	CR	\$29.81		\$10.08

GLAZIER	CR	\$35.60		\$14.41
INSULATION WORKER	CR	\$40.02		\$19.92
IRONWORKER - FENCE ERECTOR	CR	\$40.02		\$19.92
IRONWORKER - ORNAMENTAL	CR	\$31.17	510	\$24.38
IRONWORKER - REINFORCING	CR	\$29.20	510	\$23.57
IRONWORKER - STRUCTURAL	CR	\$33.12		\$25.63
MILLWRIGHT	CR	\$38.61		\$17.21
PAINTER	CR	\$28.55		\$11.87
PAINTER-INDUSTRIAL	CR	\$35.55		\$15.28
PILEDRIIVER	SR	\$36.60	005	\$16.78
PLUMBER	CR	\$46.21		\$24.90
POWER EQUIPMENT OPERATOR - BACKHOE	CR	\$33.00	510	\$13.55
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	CR	\$32.23	510	\$14.62
POWER EQUIPMENT OPERATOR - BULLDOZER	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	CR	\$44.35		\$0.00
POWER EQUIPMENT OPERATOR - CRANE	CR	\$41.00		\$18.10
POWER EQUIPMENT OPERATOR - CRANE - TOWER	CR	\$41.00		\$18.10
POWER EQUIPMENT OPERATOR - DRILL - RIG	CR	\$33.16		\$14.15
POWER EQUIPMENT OPERATOR - EXCAVATOR	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - FORKLIFT	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - GRADALL	CR	\$34.00	510	\$13.55
POWER EQUIPMENT OPERATOR - GRADER	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - GUARD RAIL POST DRIVER	CR	\$23.50		\$5.07
POWER EQUIPMENT OPERATOR - LOADER	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - MECHANIC	CR	\$36.24		\$14.62
POWER EQUIPMENT OPERATOR - MILLING MACHINE	CR	\$30.58	510	\$13.55
POWER EQUIPMENT OPERATOR - PAVER	CR	\$32.10	510	\$13.55
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	CR	\$32.10	510	\$13.55
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	CR	\$28.60		\$14.62
POWER EQUIPMENT OPERATOR - SCREED	CR	\$30.00	510	\$11.80
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	CR	\$32.23		\$14.62
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	CR	\$37.50		\$14.85
RESILIENT FLOOR	CR	\$34.12		\$14.86
ROOFER/WATERPROOFER	SR	\$52.21	009	\$14.91
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	CR	\$47.92		\$24.44
SPRINKLERFITTER	CR	\$42.32	510	\$26.05
STEAMFITTER/PIPEFITTER	CR	\$46.21		\$24.90
STONE MASON	CR	\$44.30	510	\$21.22
TILE & TERRAZZO FINISHER	CR	\$28.09		\$12.59
TILE & TERRAZZO MECHANIC	CR	\$33.41		\$14.24
TRUCK DRIVER - DUMP	CR	\$17.64	510	\$1.92
TRUCK DRIVER - FLATBED	CR	\$20.94		\$7.63
TRUCK DRIVER - LOWBOY	CR	\$29.68	510	\$10.51
TRUCK DRIVER - TACK/TAR TRUCK	CR	\$27.35	510	\$8.97

LABORER GROUP II

LABORER - ASPHALT RAKER	AD	\$22.63		\$4.88
-------------------------	----	---------	--	--------

LABORER - COMMON	AD	\$22.63	\$4.88
LABORER - CONCRETE PUDDLER	AD	\$22.63	\$4.88
LABORER - CONCRETE TENDER	AD	\$22.63	\$4.88
LABORER - CONCRETE VIBRATOR	AD	\$22.63	\$4.88
LABORER - DENSITY GAUGE	AD	\$22.63	\$4.88
LABORER - FIREPROOFER - MIXER	AD	\$22.63	\$4.88
LABORER - FLAGGER	AD	\$22.63	\$4.88
LABORER - GRADE CHECKER	AD	\$22.63	\$4.88
LABORER - HAND ROLLER	AD	\$22.63	\$4.88
LABORER - JACKHAMMER	AD	\$22.63	\$4.88
LABORER - LANDSCAPING	AD	\$22.63	\$4.88
LABORER - LAYOUT	AD	\$22.63	\$4.88
LABORER - LUTEMAN	AD	\$22.63	\$4.88
LABORER - MORTAR MIXER	AD	\$22.63	\$4.88
LABORER - PLASTERER - HANDLER	AD	\$22.63	\$4.88
LABORER - TAMPER	AD	\$22.63	\$4.88
LABORERS GROUP I			
LABORER - AIR TOOL OPERATOR	AD	\$24.46	\$9.69
LABORER - ASPHALT PAVER	AD	\$24.46	\$9.69
LABORER - BLASTER - DYNAMITE	AD	\$24.46	\$9.69
LABORER - BURNER	AD	\$24.46	\$9.69
LABORER - CONCRETE SURFACER	AD	\$24.46	\$9.69
LABORER - HAZARDOUS MATERIAL HANDLER	AD	\$24.46	\$9.69
LABORER - MASON TENDER	AD	\$24.46	\$9.69
LABORER - PIPELAYER	AD	\$24.46	\$9.69
LABORER - SCAFFOLD BUILDER	AD	\$24.46	\$9.69

Incidental Craft Data: Caulker, Man Lift Operator, Rigger, Scaffold Builder, and Welder receive the wage and fringe rates prescribed for the craft performing the operation to which welding, scaffold building, rigging, operating a Man Lift, or caulking is incidental.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement or onsite job posting for a public work contract that exceeds \$250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

Modification Codes:

(AD) 17-209 Annual Determination from Survey Wage Data Received
(CH) 17-211 Commissioners' Hearing
(CR) 17-208 Commissioners' Review
(SR) 17-208 Survey Review by Staff

Each "Borrowed From" county is identified with the FIPS 3-digit county code unique for the specific jurisdiction in Maryland.

For additional information on the FIPS (Federal Information Processing Standard) code, see <http://www.census.gov/datamap/fipslist/AllSt.txt>

The Prevailing Wage rates appearing on this form were originally derived from Maryland's annual Wage Survey. The Commissioner of Labor & Industry encourages all contractors and interested groups to participate in the voluntary Wage Survey, detailing wage rates paid to workers on various types of construction throughout Maryland.

A mail list of both street and email addresses is maintained by the Prevailing Wage Unit to enable up-to-date prevailing wage information, including Wage Survey notices to be sent to contractors and other interested parties. If you would like to be included in the mailing list, please forward (1) your Name, (2) the name of your company (if applicable), (3) your complete postal mailing address, (4) your email address and (5) your telephone number to PWMAILINGLIST@dli.state.md.us. Requests for inclusion can also be mailed to: Prevailing Wage, 1100 N. Eutaw Street - Room 607, Baltimore MD 21201-2201.

BALTIMORE COUNTY, MARYLAND
USE OF MINORITY BUSINESS ENTERPRISES AND WOMEN'S BUSINESS ENTERPRISES
IN
COUNTY CONTRACTS
MWBE Plan Package



Division of Diversity, Equity and Inclusion
The Jefferson Building
105 West Chesapeake Avenue
Towson, Maryland 21204
410-887-3407

www.baltimorecountymd.gov/go/mwbe



PROSPECTIVE BIDDERS/OFFERORS

Baltimore County Executive Order 2022-005 Use of Minority Business Enterprises and Women's Business Enterprises states:

SECTION 6. BID REQUIREMENTS.

- (A)(1) *All bidders shall submit a list of all subcontractors contacted in preparation of their bid package or proposal.*
(2) *The list shall include the service to be performed, bid amount, and the race/ethnicity/gender of the business owner(s).*
(B)(1) *All bidders shall submit a list of all subcontractors to be used on a county contract in the bid package.*
(2) *This list shall include all subcontractors (both MWBE and non-MWBE) used, the service to be performed, the total amount to be paid, and the race/ethnicity/gender of the owner.*

If the solicitation includes a MWBE **subcontracting** goal, you **MUST** demonstrate “**Good Faith**” **effort** either by:

1. Complete and sign FORM A, FORM B (to include FORM B-Prime if MWBE Prime wishes to count towards the goal) and FORM C **listing all subcontractors** with the initial bid submission.
 - a. *All Forms must be completed and signed. However, FORM C **MUST** be completed and signed by both the prime and the MWBE subcontractor.*
- OR**
2. If you are unable to meet any portion of the goal, you **MUST** do one of the following:
 - a. If you are requesting a **partial waiver**, complete and sign FORM A with initial bid submission. FORM B (to include FORM B-Prime if MWBE Prime wishes to count towards the goal) and FORM C (**listing all subcontractors**). In addition, complete, sign and submit FORM D and FORM E **accompanied with all supporting documentation** for the portion of the goal that will not be achieved as specified on FORM A.
 - b. If you are requesting a **full waiver**, complete and sign FORM A indicating your intent to request a full waiver **accompanied with a completed and signed FORM C listing all subcontractors**, FORM D and FORM E **accompanied with all supporting documentation**. **This MUST be submitted with the initial bid as specified on FORM A.**
 - c. *All Forms must be completed and signed. FORM C and FORM D **MUST** be completed and properly signed by **both the Prime AND the MWBE subcontractor(s)**.*

NOTE: The MWBE **subcontracting** goal applies to **ALL** prime/general contractors including certified and non-certified minority and women owned firms. **However, a Minority-owned or a Women-owned prime may self-perform up to 50% of MWBE subcontracting goal set in the solicitation. The MWBE primes that wish to count towards the goal must list themselves on all appropriate forms.**

12/2023

BALTIMORE COUNTY, MARYLAND

MWBE PARTICIPATION SUMMARY

Executive Order: Minority Business Enterprises and Women Business Enterprises (MWBE) shall have the maximum opportunity to participate in the performance of contracts financed in whole, or in certain circumstances, in part with County funds. Accordingly, on December 6, 2022, the County Executive adopted the EXECUTIVE ORDER No. 2022-005 addressing MWBE participation in County contracts. The December 6, 2022 Executive Order may be found on the Baltimore County website at www.baltimorecountymd.gov/go/mwbe.

Each Contract: The County shall establish a minimum MWBE participation amount for each contract, as applicable.

Bidder/Offeror Responsibility: The bidder/offeror shall ensure that MWBE participation occurs in accordance with the contract requirements and the County Executive's Executive Order. All bidder/offerors shall ensure that MWBE have the maximum opportunity to compete for and perform County contracts, as applicable. Baltimore County, Maryland, and/or its bidder/offerors and contractors shall not discriminate on the basis of race, color, national origin, disability or sex in the award and performance of any County contract.

Mobilization Payments: For subcontractors, project start-up costs can also be significant. A subcontractor that has limited resources and access to credit may find that start-up expenses inhibit its ability to bid County contracts. Under circumstances where mobilization payments are approved for the prime contractor, the subcontractor should be paid an amount equal to their participation percentage no later than five (5) business days before they are required to mobilize to perform the contracted work.

Mobilization costs represent pre-contract costs incurred by a contractor to prepare a job site before the actual commencement of the contract. These costs can include movement of personnel and equipment to the project site and for the establishment of the Contractor's offices, buildings, and other facilities necessary to begin work.

APPROVED MWBE LISTINGS

Published compilations of approved and certified MWBE, contractors, subcontractors, material suppliers, etc. include:

DIRECTORY OF MINORITY BUSINESS ENTERPRISE (MDOT):

<https://marylandmdbe.mdbecert.com>

MINORITY BUSINESS DIRECTORY OF THE CITY OF BALTIMORE:

<https://baltimorecity.diversitycompliance.com>

BIDDER/OFFEROR'S ACTIONS

Seeking Firms:

The bidder/offeror will seek commitments by subcontract or otherwise from MWBE firms for supplies and/or services, any combined value of which equals or exceeds the required percentage of MWBE participation goal for the County contract. However a MWBE Prime that affirms its MWBE status on the Minority and/or Women Prime Participation Affidavit may count up to 50% of the goal.

Expenditures for Materials and Supplies:

A bidder/offeror may count toward its MWBE contract requirements all expenditures for materials and supplies obtained from MWBE suppliers and manufacturers, provided that the MWBE firm is furnishing and installing the materials and is certified to perform these services. If the MWBE firm is only being used as a supplier, wholesaler and/or regular dealer or is not certified to install the supplies/materials, for purposes of achieving the MWBE participation goal, you may only count sixty percent (60%) of the value of the subcontract for these supplies/products (60% Rule). To apply the 60% Rule, first divide the amount of the subcontract for these supplies/products only (not installation) by the total Contract value. Then, multiply the result by sixty percent (60%) and insert the percentage in the Percent of Total Contract field of Form B Subcontractor Participation Schedule.

BALTIMORE COUNTY, MARYLAND **MWBE PARTICIPATION SUMMARY**

Information to be supplied: All bidder/offers shall submit the following information to the County at the time of bid submission:

1. The name of an employee designated as the bidder/offers' liaison to the County's Minority Business Enterprise Office.
2. The following forms shall be completed and submitted:
 - Certified MWBE Utilization and Fair Solicitation Affidavit (**Form A**); from among those names appearing in the Approved MWBE Listings (excepting Federal Highway Administration projects, which exclusively require DBE approved and certified by the Maryland Department of Transportation MBE Advisory Committee);
 - A Subcontractor Participation Schedule (**Form B**) completed by the prime contractor for each MWBE listed on the Form.
 - A MWBE Prime Participation Schedule (Form B-Prime) completed by a MWBE prime contractor if the firm wishes to self-perform up to 50% of the MBE/WBE goal.
 - A MWBE Disclosure and Participation Statement (**Form C**) completed and signed by the prime contractor and MWBE firm for each MWBE listed on the Form. Form C **must match** what is stated on Form B.
 - If applicable, MWBE Subcontractor Unavailable Certificate (**Form D**) completed and signed by the prime contractor and MWBE for each MWBE listed on the Form.
3. If applicable, MWBE Outreach Efforts - Compliance Statement (**Form E**) completed and signed by the Bidder/Offers. The prime shall submit a list of all subcontractors.
4. For DPW contracts, if the bidder/offers intends to fulfill the MWBE requirements by use of a joint venture, he/she must submit a Joint Venture Disclosure Affidavit (**Form D-EEO-006-A** and **B**) showing the extent of MWBE participation. If a bidder/offers intends to use a MWBE joint venture as a subcontractor to meet its MWBE requirements, the affidavit must be submitted through the bidder/offers by the proposed subcontractors and signed by all parties.
5. If the bidder/offers' proposed MWBE participation does not meet the MWBE contract requirements, information sufficient to demonstrate that the bidder/offers has made every effort to meet the requirements must be submitted. (See DETERMINATION OF BID RESPONSIVENESS hereafter)

RECORDS AND REPORTS

Returning Records: The bidder/offers must keep such records as are necessary to determine compliance with its MWBE utilization requirements:

1. The MWBE and non-minority contractors, type of work being performed, actual values of work and services.
2. Documentation of all correspondence, contacts, telephone calls, etc., to obtain MWBE services for the contract.
3. All prime contractors and MWBE sub-contractors are required to report monthly, by the 10th of each month, to the County through an online system called PRISM. If the contractor cannot submit his/her report on time, he/she will notify the County MWBE office and request additional time to submit the report. Failure of the contractor to report in a timely manner may result in a finding of noncompliance. The County in its sole discretion and/or upon written request may require additional reports regarding MWBE. In the event you are not able to enter your payments in PRISM, a spreadsheet is attached for your use. Please be sure to list the PO for each invoice/ payment reported and include in your submission any corresponding documentation (e.g. copies of invoices or cancelled checks).

Retaining Records: All MWBE records must be retained for 3 years following the expiration or any earlier termination of the contract and shall be available for inspection and photocopying by the County.

Investigation and Notification: Whenever the County believes the bidder/offers, contractor, or any subcontractor may not be operating in compliance with the MWBE requirements, the County may, in its sole discretion, conduct an investigation. If the County finds the bidder/offers, contractor, or any subcontractor is not in compliance with the MWBE requirements, the County may exercise any and all rights and remedies available to the County, under the contract, at law or equity, as deemed applicable and appropriate by the County in its sole discretion.

BALTIMORE COUNTY, MARYLAND **MWBE PARTICIPATION SUMMARY**

DETERMINATION OF BID RESPONSIVENESS

Request for Deviation: If the bidder/offeror is unable to procure from MWBE firms (by subcontract or otherwise), supplies and services, any combined value of which equals the required percentage of the total value of the contract, the bidder/ offeror may request, in writing, a deviation or waiver of the contract requirements. To obtain such a waiver, the bidder/ offeror must submit the following information at the time bids are due:

1. The request for waiver request shall include (1) a signed unavailability statement (Form D) executed by all MBEs and WBEs that the bidder/offeror solicited for participation and (2) Outreach Efforts/Compliance Statement (Form E) that demonstrates the bidder/offeror's good faith efforts to comply with the contract requirements, including copies of solicitation documentation to all potential subcontractors:
2. Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder/offeror contacted each MWBE; and
3. Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.

Bid Rejection: The failure of any bidder/offeror (including the apparent low bidder/offeror) to provide a responsive MWBE Plan as required by the solicitation may result in the bidder/offeror being deemed non-responsive and the County's rejection of the bid.

Liquidated Damages If the County issues a notice of intent to awards contract to the apparent low bidder/offeror who provided a responsive MWBE Plan, but, if after said notice and before execution of Contract Documents, it is determined by the County that the apparent low bidder/offeror has failed to comply with the MWBE Plan, such failure may result in the recommendation by the appropriate Procurement Official to annul the award and forfeit the bidder/offeror's Proposal Guaranty to the County, not as a penalty, but as liquidated damages, it being acknowledged that actual damages will be difficult if not impossible to accurately measure. In addition, the County may proceed as it determines to be in its best interest, including but not limited to, the Notice of Award may be made to the next lowest responsive and responsible bidder/offeror or the work may be re-advertised.

Contract Breach: If, after execution of a County contract, the contractor becomes aware it may or will fail to fulfill the applicable MWBE requirements and/or may or will deviate from the contractor's bid response/contract terms, the contractor shall promptly advise the County of this in writing. Thereafter, the County will determine what action or remedy is appropriate on a case-by-case basis, in the County's sole discretion.

Approval Required for Changes: Any and all changes to the MWBE subcontractors or the type or amount of work to be performed by such subcontractors during the contract term must be mutually agreeable to the County and the contractor and shall be documented via a contract amendment, executed by legally authorized representatives of the County and the contractor.

Cooperation in Reviews: The bidder/offeror will cooperate with the County in any reviews of the contractor's procedures and practices with respect to MBE or WBE firms, which the County may from time to time conduct in its sole discretion.

Other: If the documents used to determine the contractor's efforts, achievement of, and/or the status of an MWBE requirement or fulfillment thereof contain false, misleading or misrepresented information, the contractor may be declared in breach of the contract and the County may take any and all actions and/or remedies available to the County under the contract, at law, or in equity. If an MWBE is disqualified by any public entity, including but not limited to, Baltimore City, the State or MDOT, at any time after award or during the term of the contract, the County may, in its sole discretion, require the prime contractor to promptly submit for County approval, the contractor's plans for fulfilling the required MWBE participation under the contract, and/or request such detail and additional information as the County, in its discretion deems appropriate.



PRIME CONTRACTOR MINORITY AND WOMEN PARTICIPATION AFFIDAVIT

A. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____ and the duly authorized representative of
[business]_____

_____ (the "Business") and that I possess the legal authority to make this Affidavit on behalf of myself and the Business for which I am acting.

B. AFFIRMATION REGARDING MINORITY AND WOMEN PARTICIPATION

I FURTHER AFFIRM THAT:

I am aware that, pursuant to the December 6, 2022 Executive Order of Baltimore County, Maryland, the following words have the meanings indicated.

(A) "Minority Business Enterprise" or "MBE" means a business enterprise that is owned, operated and controlled by one or more minority group members (African American, Hispanic American, Asian American, or Native American) who have at least 51% ownership and in which the minority group members have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

(B) "Women's Business Enterprise" or "WBE" means a business enterprise that is owned, operated and controlled by one or more women who have at least 51% ownership and in which the women have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

_____ The Prime is a MBE ☐ or WBE ☐

☐ Maryland State Department of Transportation (MDOT) # _____

☐ City of Baltimore # _____

☐ Name Other Jurisdiction: _____ # _____

☐ The ownership of the Noncertified MWBE business consists of _____% minorities and _____% women (for a total of _____%), each of which has operational and managerial control, interest in capital and earnings commensurate with their percent ownership.

_____ % African American _____ % Hispanic American _____ % Women
_____ % Asian American _____ % Native American _____ % Disadvantaged (DBE)

_____ The MWBE prime anticipates meeting up to 50% of the stated participation goal with its own workforce.

MWBE primes percentage must be stated on the MWBE PRIME PARTICIPATION SCHEDULE (FORM B-PRIME) to count towards the goal.

_____ The prime anticipates ☐ does not anticipate ☐ utilizing subcontractors for _____% of the work of the contract requirements, of which it anticipates _____% will be MBEs and _____% will be WBEs.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: _____

By: _____

(Authorized Representative and Affiant's Name and Title)

BALTIMORE COUNTY, MARYLAND
Certified MWBE Utilization and Fair Solicitation Affidavit
(FORM A)

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

* * * * *

I acknowledge the goal for solicitation # _____ is a minimum of ____%. This goal must be met by any combination of the MWBE subcontractors. However, for instances where the Prime is counting up to 50% of the goal, the remaining goal balance must be met by any combination of the MWBE subcontractors.

- The goal breakdown is as follows:
 - ____% Minority/Women Prime
 - ____% for certified MBE-owned businesses and/or
 - ____% for certified WBE-owned businesses.

I have made a good-faith effort to achieve this MWBE solicitation requirement. If awarded the contract, I will comply with this MWBE contract requirement and will continue to use my best efforts to increase MWBE participation during the contract term.

PLEASE CHECK ONE BOX (EITHER 1, 2, OR 3)

1 ☐ Prime has met the MWBE contract requirements for this solicitation and contract. I submit the Subcontractor Participation Form B and Form C, along with this Affidavit, which details how the Prime will achieve the contract requirements. Submit a complete list of all additional subcontractors

Or

2 ☐ After having made a good-faith effort to achieve the MWBE requirements, the Prime can only achieve partial success. I submit the Subcontractor Participation Form B, Form C, Form D and Form E along with this Affidavit, which details how the Prime will partially achieve the contract requirements. Submit a complete list of all additional subcontractors

I request a partial waiver and will meet the following MWBE participation goals:

- Partial waiver of MWBE subcontract participation:
 - ____% Minority/Women Prime
 - ____% for certified MBE-owned businesses and/or
 - ____% for certified WBE-owned businesses.

Or

3 ☐ After having made a good faith effort to achieve the MWBE requirements for this contract, the Prime is unable to achieve the requirements and/or sub requirements for this contract. I submit the MWBE Participation Form D and Form E, along with this Affidavit, which details the steps the Prime has taken in an attempt to achieve the contract requirements. Therefore, I request a full waiver.

IF YOU HAVE CHECKED BOX 2 OR 3, THE FOLLOWING IS APPLICABLE:

- 1) If a bidder is unable to comply with the goals established in a bid for a project, the bidder may submit a request for a waiver at the time of bid submission. However, occasions for granting waivers will be limited.

BALTIMORE COUNTY, MARYLAND
Certified MWBE Utilization and Fair Solicitation Affidavit
(FORM A)

- 2) The request for waiver shall include documentation that demonstrates the bidder's good faith efforts to comply with the goals, including:
- a. Signed unavailability statements from all MBEs and WBEs that the bidder solicited for participation; and
 - b. Copies of solicitation documentation to include the scope of services to be performed by the subcontractors accompanied with the following:
 - i. Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder contacted each; and
 - ii. Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.
 - iii. Responses from MWBE firms contacted to fulfill the goal.

As I have checked Box 2 or 3 of this Affidavit, I understand I must submit the following supporting documentation with the bid:

- *Subcontractor Participation Schedule* (Form B)
- *MWBE Subcontractor Disclosure and Participation Statement* (Form C)
- *MWBE Subcontractors Unavailable Certificate* (Form D) (if applicable)
- *MWBE Outreach Efforts – Compliance Statement* (Form E) (if applicable)

I acknowledge that the MWBE subcontractors/suppliers listed on the *Subcontractor Participation Schedule* (Form B) will be used to accomplish the percentage of MWBE participation that the Prime shall achieve. A fully executed Form C must match Form B.

In the solicitation of subcontract quotations or offers, MWBE subcontractors were provided the same information and amount of time to respond, as were non-MWBE subcontractors.

The solicitation process was conducted in such a manner so as to not place MWBE subcontractors at a competitive disadvantage to non-MWBE subcontractors.

I solemnly affirm under the penalties of perjury that this Affidavit is true to the best of my knowledge, information, and belief.

Bidder/Offeror Name

Phone Number

Address

Affiant Signature

Address (continued)

Printed Name & Title

E-mail address

Date

BALTIMORE COUNTY, MARYLAND
SUBCONTRACTOR PARTICIPATION
SCHEDULE (FORM B)

*This document must be completed and submitted with Bid/Proposal to
 Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Prime Name Bid/Proposal Name and Number 1. Subcontractor Name and Tax ID Telephone Number _____ Email Address _____ Select One: <input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SBE <input type="checkbox"/> N/A Provide if Applicable: <input type="checkbox"/> MDOT <input type="checkbox"/> Baltimore City # _____	Prime Address, Telephone Number and Email Project Location Base Bid \$ _____ Subcontractor Address Minority Status (If applicable): <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> African American <input type="checkbox"/> Asian American Pacific <input type="checkbox"/> Asian American Sub-continent <input type="checkbox"/> Supplier, Wholesaler and/or Regular Dealer - 60% Rule </div> <div> <input type="checkbox"/> Female <input type="checkbox"/> Native American <input type="checkbox"/> Hispanic American </div> </div>
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount 2. Subcontractor Name and Tax ID Telephone Number _____ Email Address _____ Select One: MBE <input type="checkbox"/> WBE <input type="checkbox"/> SBE <input type="checkbox"/> N/A <input type="checkbox"/> Provide if Applicable: <input type="checkbox"/> MDOT <input type="checkbox"/> Baltimore City # _____	Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule) _____% Subcontractor Address Minority Status (If applicable): <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> African American <input type="checkbox"/> Asian American Pacific <input type="checkbox"/> Asian American Sub-continent <input type="checkbox"/> Supplier, Wholesaler and/or Regular Dealer - 60% Rule </div> <div> <input type="checkbox"/> Female <input type="checkbox"/> Native American <input type="checkbox"/> Hispanic American </div> </div>
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount 3. Subcontractor Name and Tax ID Telephone Number _____ Email Address _____ Select One: MBE <input type="checkbox"/> WBE <input type="checkbox"/> SBE <input type="checkbox"/> N/A <input type="checkbox"/> Provide if Applicable: <input type="checkbox"/> MDOT <input type="checkbox"/> Baltimore City # _____	Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule) _____% Subcontractor Address Minority Status (If applicable): <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> African American <input type="checkbox"/> Asian American Pacific <input type="checkbox"/> Asian American Sub-continent <input type="checkbox"/> Supplier, Wholesaler and/or Regular Dealer - 60% Rule </div> <div> <input type="checkbox"/> Female <input type="checkbox"/> Native American <input type="checkbox"/> Hispanic American </div> </div>
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount Subcontractor Total Dollar Amount \$ _____	Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule) _____% Total Subcontractor Percent of Entire Contract _____%
Form Prepared by: Name/Date: _____ Title: _____ Email: _____	Reviewed and Accepted by Baltimore County Minority Business Enterprise Office Name _____ Title _____ Date _____

MBE or WBE Prime Participation Total	_____ %	\$ _____	
MBE Subcontracting Participation Total	_____ %	\$ _____	
WBE Subcontracting Participation	_____ %	\$ _____	
Total MWBE Participation	_____ %	\$ _____	
Total SBE Participation	_____ %	\$ _____	

BALTIMORE COUNTY, MARYLAND

**MWBE PRIME PARTICIPATION SCHEDULE
(Form B-Prime)**

PLEASE COMPLETE AND SUBMIT THIS FORM TO ATTEST EACH SPECIFIC ITEM OF WORK THAT YOU AS THE MWBE PRIME FIRM WILL PERFORM USING ITS OWN WORKFORCE PERTAINING TO THE PERCENTAGE STATED ON THE SUBCONTRACTOR PARTICIPATION SCHEDULE (FORM B) FOR PURPOSES OF MEETING THE MWBE PARTICIPATION GOALS.

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Provided that _____ (Prime Contractor's Name) with Certification Number _____ is awarded the County contract in conjunction with Solicitation No. _____, such MWBE Prime Contractor intends to count the distinct, clearly defined portion of the work of the contract that the MBE/WBE Prime Contractor performs with its own forces toward fulfilling **up to fifty-percent (50%) of the MWBE participation goal**, at least \$ _____ which equals to _____% of the Total Contract Amount for performing the following products/services for the Contract:

NAICS CODE	WORK ITEM, SPECIFICATION NUMBER, LINE ITEMS OR WORK CATEGORIES (IF APPLICABLE). FOR CONSTRUCTION PROJECTS, GENERAL CONDITIONS MUST BE LISTED SEPARATELY.	DESCRIPTION OF SPECIFIC PRODUCTS AND/OR SERVICES	VALUE OF THE WORK

MWBE PRIME CONTRACTOR

Signature of Representative: _____

Printed Name and Title: _____

Firm's Name: _____

Federal Identification Number: _____

Address: _____

Telephone: _____

Email Address: _____

Certified Yes No No

Certifying Jurisdiction _____

Date: _____

MWBE PRIME CONTRACTOR

Minority Status:

- ☐ African American
- ☐ Hispanic American
- ☐ Women
- ☐ Asian American
- ☐ Native American

Reviewed and Accepted by Baltimore County Minority Business Enterprise Office

Name _____

Title _____

Date _____

BALTIMORE COUNTY, MARYLAND
MWBE SUBCONTRACTOR DISCLOSURE AND PARTICIPATION STATEMENT
(FORM C)

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

NOTE: ANY INCONSISTENCY BETWEEN THIS FORM AND FORM B MWBE PARTICIPATION MAY RENDER A BID/PROPOSAL NON-RESPONSIVE AND THE COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Contract Name, Bid/Proposal Number: _____

Prime Contractor Name: _____

Name of MWBE Subcontractor: _____

Subcontractor Contact Name, Title _____

Subcontractor Email Address _____

☐ MDOT ☐ Baltimore City

_____ Certification Number

☐ MBE ☐ WBE ☐ SBE ☐ N/A

1. NAICS Code(s), Work/Services to be performed by MWBE Subcontractor: _____

Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)

2. Subcontract Amount: \$ _____ or _____ % of the County contract cost.

3. Bonds - Amount and type required of Subcontractor if any: _____

4. MWBE Anticipated Commencement Date: _____ Completion Date: _____
Mobilization Cost Amount \$ _____

5. This is a MBE-Owned Business Firm: Yes _____ No _____

6. This is a WBE-Owned Business Firm: Yes _____ No _____

NOTE: If the Prime is notified that it will be awarded the above referenced contract, the undersigned MWBE subcontractor and Prime must enter into a subcontract for the work/service indicated above upon the Prime's execution of a contract for the above referenced project with Baltimore County, and provide a copy of the fully executed MWBE SUBCONTRACTOR PARTICIPATION NOTICE OF INTENT TO AWARD (FORM C-Subcontractor) accompanied with the anticipated Work Breakdown Schedule (providing the subcontractor's mobilization timeframe) to mwbe@baltimorecountymd.gov within 10 calendar days of receipt by the Prime of FORM C- Subcontractor from the County. The undersigned subcontractor is an MDOT or Baltimore City certified MWBE firm. The terms and conditions stated above are consistent with our agreements.

Signature of MWBE Subcontractor: _____ Date: _____

Prime's Printed Name and Title: _____ Email: _____

The terms and conditions stated above are consistent with our agreements.

Signature of Prime: _____ Date: _____

Revised 12/2024

BALTIMORE COUNTY, MARYLAND
MWBE –UNAVAILABILITY CERTIFICATE
(FORM D)

If applicable, this document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

1. It is hereby certified that the firm of _____
(Name of Minority firm)

located at _____
(Number) (Street)

(City) (State) (Zip)

was offered an opportunity to bid on the _____ contract.

2. The _____ (MWBE Firm), is either unavailable for the work/service or unable to prepare a bid for this project for the following reason(s):

Signature of Subcontractor MWBE Representative

Title

Date

MDOT/Baltimore City Certification #

Email Address #

Telephone #

3. PRIME'S SIGNATURE AND CERTIFICATION

I certify under oath that I contacted the Certified MWBE and they advised me that they are unavailable, unable to perform the work/services for the above-contract or failed to respond to repeated requests for a price proposal for the above-contract.

Signature of Prime

Title

Date

Rev 12/2024

BALTIMORE COUNTY, MARYLAND
MWBE - OUTREACH EFFORTS - COMPLIANCE STATEMENT
(FORM E)

****This document must be completed and submitted with Bid/Proposal to Baltimore County.***

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

In conjunction with the bid or offer submitted in response to Solicitation Number _____, I state the following:

1. Bidder/Offeror identified opportunities to subcontract in these specific work categories:

2. Attached to this form are copies of the solicitation documentation in accordance with Section 6 (E) Bid Requirements of the Executive Order, used to solicit certified MWBEs for the subcontract opportunities accompanied with the signed MWBE Subcontractor Unavailability Certificate (Form D).

3. Bidder/Offeror made the following attempts to solicit MWBEs:

Signature – Bidder Offeror

Print or Type Name of Firm

Street Address

City State Zip Code

Date



JOHN A. OLSZEWSKI, JR.
County Executive

SEVETRA PEOPLES-BROWN
Executive Director
Chief of Diversity, Equity and Inclusion

To: Contractors/Consultants

From: Minority and Women Business Enterprise Office

Date: December 13, 2024

Subject: Compliance Reporting and Penalties

Baltimore County, Maryland (the "County") requires all Prime Contractors and all Subcontractors to submit payment reports by the 10th of each month through an online MWBE Compliance Portal (PRISM). The Portal can be found under Compliance Reporting for Primes and Subcontractors at www.baltimorecountymd.gov/go/mwbe. In the event you are not able to enter your payments in PRISM, a spreadsheet is attached for your use. Please be sure to list the PO for each invoice/ payment reported and include in your submission any corresponding documentation (e.g. copies of invoices or canceled checks).

The County has found that a number of companies are failing to file reports in a timely manner, which makes it difficult for the County to verify compliance. As a result, the County has determined to assess penalties for non-compliance, effective September 1, 2018, as follows:

- (a) For failure to file timely monthly reports:
 - a. Assessment of a late fee of \$10 per day per task, up to a maximum of \$1,500 per task; and/or
 - b. For multiple violations, termination of the contract for convenience or for default, with the contractor suspended from participating in County contracts for five (5) years.
- (b) For failure to meet MWBE requirements:
 - a. Assessment of a penalty of up to 10% of the contract value; and/or
 - b. Termination of the contract for convenience, with the contractor suspended from participating in County contracts for five (5) years together with assessment of a penalty of up to 10% of the contract value; and/or
 - c. Termination of the contract for default together with assessment of a penalty of 10% of the contract value.

Each action and/or remedy described above is at the sole discretion of the County, and is in addition to any damages which the County may be entitled to under the contract. This short video can be used as guidance on submitting the Prime to Subcontractor Payment Reporting:

http://stage.prismcompliance.com/etc/movies/vendor_contractpayment_tutorial.htm

If after contract expiration, it has been determined the MWBE firms named were not used or were under used, by the contractor and supporting documentation was not provided and approved by the County the contractor may be assessed a penalty of up to 10% of the contract value and/or suspended from participating in County contracts for 5 years.

Questions regarding this correspondence and/or the use of this system can be directed to the MWBE Office at mwbe@baltimorecountymd.gov or call (410) 887-3407.

Attachment: MWBE Payment Report Form
 MWBE Payment Acknowledgement Form

Cc: File

S E C T I O N V

POST AWARD DOCUMENTS

**This Section to be Completed
by Successful Bidder after Award**

CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT ("Contract"), IS MADE THIS _____ day of _____ 20____, by and between Baltimore County, Maryland, a body corporate and politic ("County"), and _____, ("Contractor").

WITNESSETH, that the Contractor, for and in consideration of the payment or payments herein specified and agreed to by the County, hereby covenants and agrees to furnish and deliver all the materials and to do and perform all the work, services, and labor in fulfillment of the requirements of Contract Number **25030 PO0** "Project") in strict conformity with the solicitation, plans, specifications, special provisions, any and all addenda, and the proposal, at the prices named therein, and all of which are collectively the Proposal, and said Proposal is attached hereto and made a part thereof.

The Project shall be done in strict compliance with (i) the Proposal, (ii) the Baltimore County Department of Public Works and Transportation September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction" (iii) and any and all revisions thereto as of the date of advertisement, including but not limited to the General Conditions Building Projects, as applicable, and all of which (i-iii) are made a part hereof and incorporated herein (collectively, the "Specifications"). Contractor understands and agrees it is Contractor's responsibility and obligation to obtain a copy of the "Specifications" and agrees the Specifications are incorporated herein. Copies are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards.

The Project shall be subject to the inspection and approval of the Office of Budget and Finance – Property Management for Baltimore County, or his authorized representative, and in the event any portion thereof shall be rejected by said Director or his representative as defective or unsuitable, then the said portion shall be removed and replaced and be performed anew to the satisfaction and approval of the said Director or his representative at the cost and expense of the Contractor.

THE CONTRACTOR AFFIRMS that it is aware of, and will comply with, the provisions of Sections 14-101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, as the same may be amended from time to time, which require that every person who makes, during any 12-month period, one or more contracts, with one or more Maryland governmental entities involving cumulative consideration, of at least \$200,000.00, to file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of \$500 during defined reporting periods.

THE CONTRACTOR FURTHER COVENANTS AND AGREES that all the Project shall be furnished, performed and delivered, in every respect, to the satisfaction and approval of the Office of Budget and Finance – Property Management, aforesaid, on or before the expiration of **Two Hundred Forty-One (241) CALENDAR DAYS** (the "Contract Period") after written notice has been given by the Director or their authorized representative to begin the work.

IT IS AGREED THAT TIME IS OF THE ESSENCE. In the event the Contractor fails to achieve Final Completion and Final Acceptance of the Contract work within the Contract Period specified herein, plus any extensions thereto agreed to in writing by a legally authorized representative of the County pursuant to the terms of this Contract, then Contractor shall pay the County the sum of **FIFTEEN HUNDRED DOLLARS (\$1500.00)** as Liquidated Damages for each **CALENDAR DAY** after the expiration of the Contract Period, as may be extended by the County, until the Contractor achieves Final Completion and Final Acceptance of the Project.

Contractor's Initials

Date

Rev. 09/2024

IT IS FURTHER AGREED that:

- (a) These Liquidated Damages are a reasonable estimate of the County's damages solely due to the public's loss of use of the Project during the delay period and is not a penalty.
- (b) It is very difficult, if not impossible, to accurately measure the damages to the County due to the public's loss of use of the Project during the delay period.
- (c) Notwithstanding GP 8.09 of the Baltimore County Standard Specification for Construction, in addition to the damages due to the public's loss of use of the Project during the delay period, the County is likely to incur additional direct costs during the delay period, including but not limited to, costs for construction management, consultants, architectural services, office trailer and supplies, utilities, County employees' time, County vehicles, and such other costs that the County will incur to continue administration of the construction and the Contract during the delay period, all of which will be monitored by the County, and if so required by the County, the Contractor shall pay such actual damages incurred during the delay period. THE PARTIES HERETO UNDERSTAND AND AGREE THAT CONTRACTOR'S OBLIGATION TO PAY THE COUNTY FOR ACTUAL DAMAGES DURING THE DELAY PERIOD SHALL BE IN ADDITION TO THE CONTRACTOR'S OBLIGATION TO PAY THE LIQUIDATED DAMAGES DUE TO THE PUBLIC'S LOSS OF USE OF THE PROJECT.
- (d) The County shall have the right, but not the obligation, to deduct the Liquidated Damages due to the public's loss of use of the Project, and the County's actual costs and costs to continue administration of the construction and the Contract, from any monies due or any monies that may become due to the Contractor.

IT IS DISTINCTLY UNDERSTOOD AND AGREED that no claim for extra work, material or overhead not specifically provided for in the Contract will be allowed by the County, nor shall the Contractor do any work or furnish any materials not covered by this Contract and the Specifications, unless the same is ordered in writing by a legally authorized representative of the Office of Budget and Finance – Property Management in accordance with the terms of the Contract. Any such work or materials which may be done or furnished by the Contractor without any such written order first being given shall be at said Contractor's sole risk, cost and expense and Contractor hereby covenants and agrees that without such written order, Contractor shall make no claim for compensation for work, materials, or overhead so done or furnished.

NOTWITHSTANDING GP 4.06 OF THE BALTIMORE COUNTY STANDARD SPECIFICATIONS FOR CONSTRUCTION, IT IS SPECIFICALLY AGREED that the Contractor shall have no entitlement to damages arising out of delay, disruption, interference or hindrance from any cause whatsoever. However, this provision shall not preclude recovery or damages by the Contractor for hindrances or delays due solely to fraud or gross negligence on the part of the County or its agents.

IT IS FURTHER DISTINCTLY AGREED that the said Contractor shall not assign this Contract, nor any part thereof, nor any right to any of the monies to be paid hereunder, nor shall any part of the work to be done or material furnished under said Contract be sublet without the prior written consent of a legally authorized representative of the Office of Budget and Finance – Property Management in accordance with the terms of this Contract. Further, the acceptance of the final payment by the Contractor shall effectuate a release in full of all claims against County and its officials, employees, representatives, and agents arising out of, or by reason of the Project and this Contract.

The Contractor shall review government issued identification and badge all employees of the Contractor and its subcontractors. The Contractor shall also review all federal forms, including but not limited to I-9's, for compliance as well as copies of all employment eligibility and identity documentation maintained to the extent required by law.

The Bonds, given by the Contractor in a sum equal to the total contract price of the Project in compliance with the terms and provisions of this Contract, are hereby attached and incorporated herein.

IT IS AGREED that in the event that the County is delayed or prevented from timely execution of this Contract, the Contractor releases County and agrees Contractor shall have no action, claim or demand against County therefore.

Contractor's Initials

Date

Rev. 09/2024

THE CONTRACTOR HEREBY FURTHER AGREES to receive the prices set forth in the Proposal incorporated herein as full compensation for the completion of the Project and, in all respects, to complete said Contract to the satisfaction of the County.

THE CONTRACTOR REPRESENTS AND WARRANTS:

- (i) it is duly formed and validly existing under the laws of the State of _____;
- (ii) it is in good standing in the State of Maryland;
- (iii) it has the power and authority to consummate the obligations and responsibilities contemplated hereby, and has taken all necessary action to authorize the execution, delivery and performance required under this Contract;
- (iv) the Contractor and the person executing this Contract for the Contractor each warrant that he/she is duly authorized by the Contractor to execute and seal this Contract on the Contractor's behalf;
- (v) the warranties of merchantability and fitness for a particular purpose and use and warranties of title and against infringement, and all express warranties contained in this Contract, including but not limited to the Proposal (and any sample or model presented by Contractor and expressly accepted by the County) shall apply to the portion of this Contract pertaining to or for goods;
- (vi) all representations and warranties made in the Proposal and herein remain true and correct in all respects when made, as of the date of this Contract, and throughout the term of this Contract; and
- (vii) there exists no actual or potential conflict of interest between its performance under this Contract and its engagement or involvement in any other personal or professional activities and in the event such conflict or potential conflict arises during the term of this Contract, the Contractor shall immediately advise the County in writing thereof.

THE CONTRACTOR shall not disclose any documentation and information of any kind or nature disclosed to the Contractor in the course of its performance of duties hereunder without the express prior written consent of the County.

Those sections in this Contract which by their nature are intended to survive, including but not limited to, Contractor's representations and warranties, confidential information, and indemnification shall survive the termination of this Contract.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand and seal the day and year first above written.

CONTRACTOR NAME: _____

WITNESS FEDERAL TAX ID or SS #: _____

By: _____ (Seal)

Name: _____

Type (Print) Name

Title: _____ Date: _____

WITNESS: **BALTIMORE COUNTY, MARYLAND**

Executive Secretary By: _____ Date: _____
D'Andrea L. Walker, County Administrative Officer

Type (Print) Name

APPROVED FOR FORM AND LEGAL
AND SUFFICIENCY* (Subject to
execution by the duly authorized
Administrative official and Chairperson
of the County Council, as indicated).

APPROVED:

Kevin D. Reed, Director
Office of Budget and Finance Date: _____

Office of the County Attorney

*Approval of Form and Legal Sufficiency does not convey approval or disapproval of the substantive nature of this transaction. Approval is based upon typeset documents. All modifications require re-approval.

Rev. 09/2024

PERFORMANCE BOND

Bond No. _____

Principal _____

Business Address of Principal _____

Surety _____

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

Penal Sum of Bond (express in words and figures)

911 Center UPS Replacement Circuit Courts Building

Contract Name

25030 PO0

Contract Number

DOLLARS

\$

Date of Contract

20

Date Bond Executed

20

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL, above-named, and SURETY, above-named, and authorized to do business in the State of Maryland, are held and firmly bound unto the OBLIGEE, above-named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE PRINCIPAL entered into a certain contract with the OBLIGEE described and dated as shown above and is required to provide this bond pursuant to Maryland State law and/or County law and the contract.

NOW, THEREFORE, if the aforesaid PRINCIPAL shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the OBLIGEE with or without notice to the SURETY, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then, this obligation to be void; otherwise to remain in full force and effect.

THE SURETY FURTHER GUARANTEES That it is (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. A Performance Bond is required for each and every Contract in excess of twenty-five thousand (\$25,000). A Performance Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Performance Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and seal of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:**Individual Principal**

Witness: _____

as to: _____ (SEAL)

Print Name: _____

Print Name: _____

Attest:**Corporate Principal**

(Name of Corporation)

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Attest:**Surety**

(Name of Surety)

Business Address: _____

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Reviewed for Baltimore County Requirements

Office of the County Attorney

PAYMENT BOND

Bond Number _____

Principal _____

Business Address of Principal _____

Surety _____

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

DOLLARS \$ _____

Penal Sum of Bond (express in words and figures) _____

911 Center UPS Replacement Circuit Courts Building
Contract Name_____ 20 _____
Date of Contract25030 PO0
Contract Number_____ 20 _____
Date Bond Executed

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL, above-named, and SURETY, above-named, and authorized to do business in the State of Maryland, are held and firmly bound unto the OBLIGEE, above-named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE PRINCIPAL entered into a certain contract with the OBLIGEE described and dated as shown above and is required to provide this bond pursuant to Maryland State law and/or County Law and the contract.

NOW, THEREFORE, the condition of this obligation is such that if the aforesaid PRINCIPAL shall promptly make payments to all persons supplying labor and/or material to the PRINCIPAL and to any subcontractor of the PRINCIPAL in the prosecution of the work provided for in said contract and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then, this obligation to be void; otherwise to remain in full force and effect.

THE SURETY FURTHER GUARANTEES That it is (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. A Payment Bond is required for each and every Contract in excess of twenty-five thousand (\$25,000). A Payment Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Payment Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and seal of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

Individual Principal

Witness: _____

as to: _____ (SEAL)

Print Name: _____

Print Name: _____

Attest:

Corporate Principal

(Name of Corporation)

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Attest:

Surety

(Name of Surety)

Business Address: _____

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Reviewed for Baltimore County Requirements

Office of the County Attorney



INSURANCE PROVISIONS

1. GENERAL REQUIREMENTS

- 1.1 Coverages Required:
Unless otherwise required by the specifications or the contract, the Contractor/Vendor shall purchase and maintain the insurance coverage's listed herein.
- 1.2 Certificate of Insurance:
Before starting work on the contract, or prior to the execution of the Contract on those bid, the Contractor/Vendor shall provide Baltimore County, Maryland with verification of insurance coverage evidencing the required coverages.
- 1.3 Baltimore County as Insured:
The coverage required, excluding Workers' Compensation and Employers' Liability and Medical Malpractice Liability/Professional Liability/Errors and Omissions Liability, must include Baltimore County, Maryland and its agents, employees, officers, directors, and appointed and elected officials as an additional insured.
- 1.4 Contractor's/Vendor's Responsibility:
The providing of any insurance herein does not relieve the Contractor/Vendor of any of the responsibilities or obligations the Contractor/Vendor has assumed in the contract or for which the Contractor/Vendor may be liable by law or otherwise.
- 1.5 Failure to Provide Insurance:
Failure to provide and continue in force the required insurance shall be deemed a material breach of the contract. The Contractor/Vendor must maintain the insurance coverages required under the terms and conditions on this Contract while this Contract is in effect including renewal and extension terms.

2. INSURANCE COVERAGES

- 2.1 General Liability Insurance
- 2.1.1 Minimum Limits of Coverage:
Personal Injury Liability and Property Damage Liability
Combined Single Limit - \$500,000 each occurrence.
- 2.1.2 Such insurance shall protect the Contractor/Vendor from claims which may arise out of, or result from, the Contractor's/Vendor's operations under the contract, whether such operations be by the Contractor/Vendor, any subcontractor, anyone directly or indirectly employed by the Contractor/Vendor or Subcontractor, or anyone for whose acts any of the above may be liable.
- 2.1.3 Minimum Coverages to be Included:
(a) Independent Contractor's coverage;
(b) Completed Operations and Products Liability coverage;
(c) Contractual Liability coverage.

- 2.1.4 Damages not to be Excluded:
Such insurance shall contain no exclusions applying to operations by the Contractor/Vendor or any Subcontractor in the performance of the Contract including but not limited to:
(a) Collapse of, or structural injury to, any building or structure;
(b) Damage to underground property; or
(c) Damage arising out of blasting or explosion.

2.2 Automobile Liability Insurance

- 2.2.1 Minimum Limits of Coverage:
Bodily Injury Liability and Property Damage Liability
Combined Single Limit - \$500,000 any one accident.
- 2.2.2 Minimum Coverages to be Included:
Such insurance shall provide coverage for all owned, non-owned and hired automobiles.

2.3 Workers' Compensation and Employers' Liability Insurance

Such insurance must contain statutory coverage, including
Employers' Liability insurance with limits of at least:
Bodily Injury by Accident - \$250,000 each accident
Bodily Injury by Disease - \$500,000 policy limit
Bodily Injury by Disease - \$250,000 each employee

2.4 Valuable Papers and Records Coverage and Electronic Data Processing (Data and Media) Coverage

Minimum Limits of Coverage:
\$100,000 Per Claim and Each Occurrence
\$100,000 in the Aggregate

2.5 Other

Such other insurance in form and amount as may be customary for the type of business being under taken by the Contractor/Vendor.

2.6 Builder's Risk

See Special Provisions page 533 and General Conditions page 34,35, Article 33.